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MONTHLY

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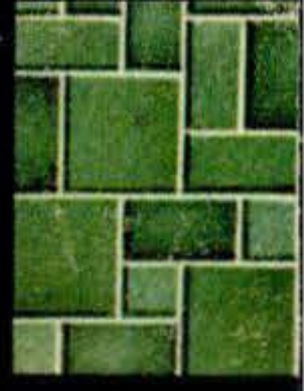
July 35¢



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He Rides a Kite

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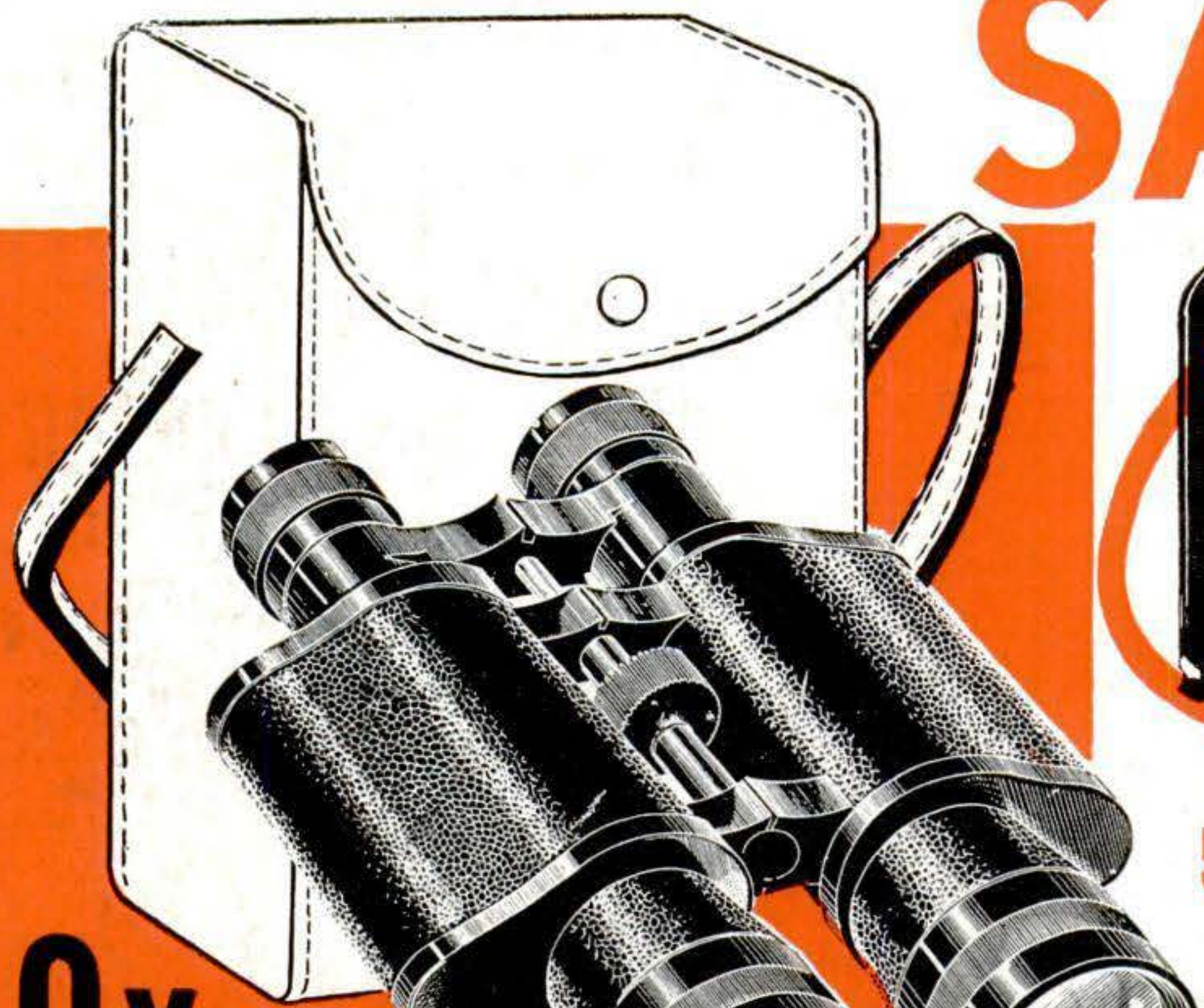

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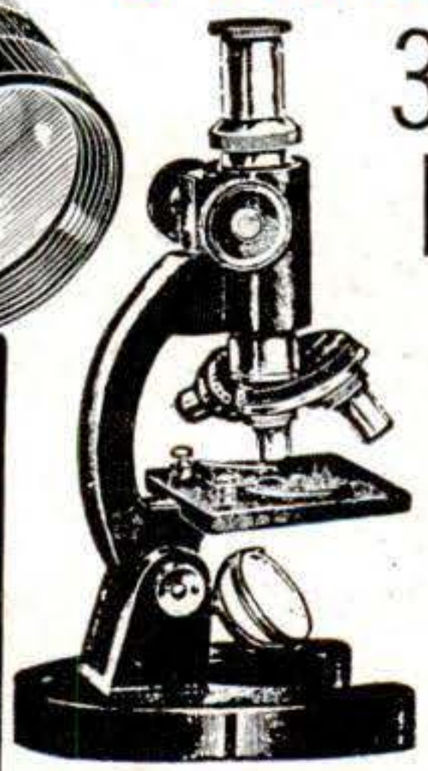

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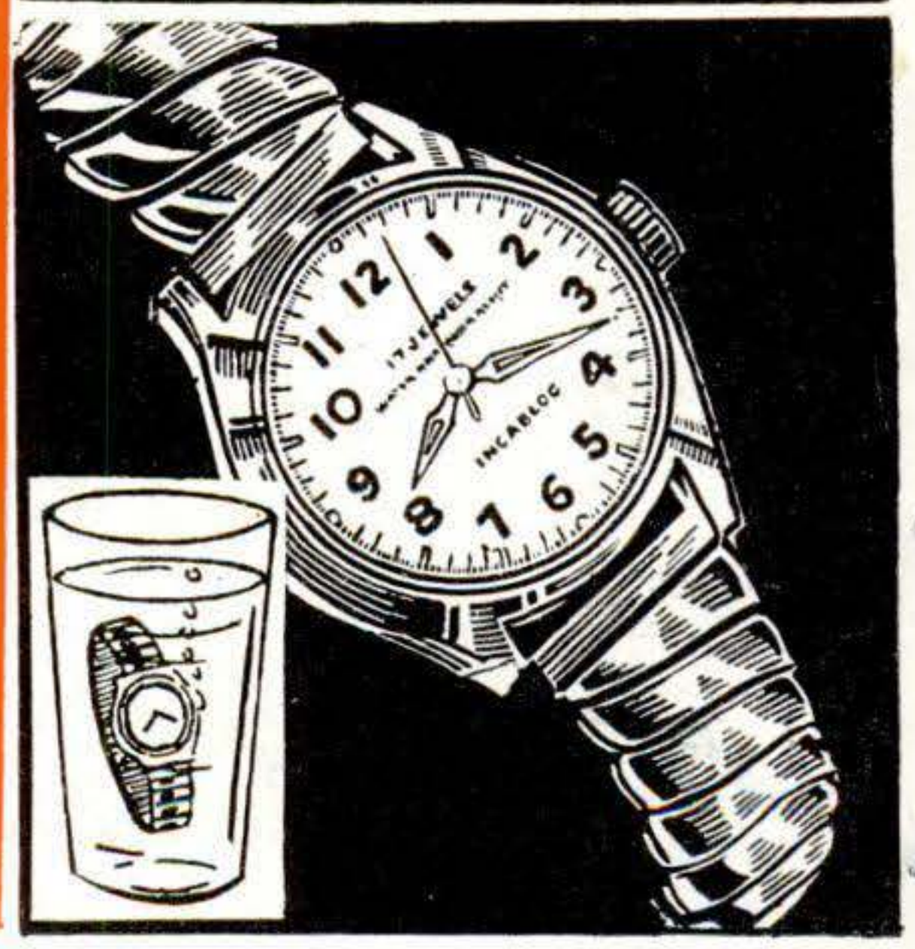

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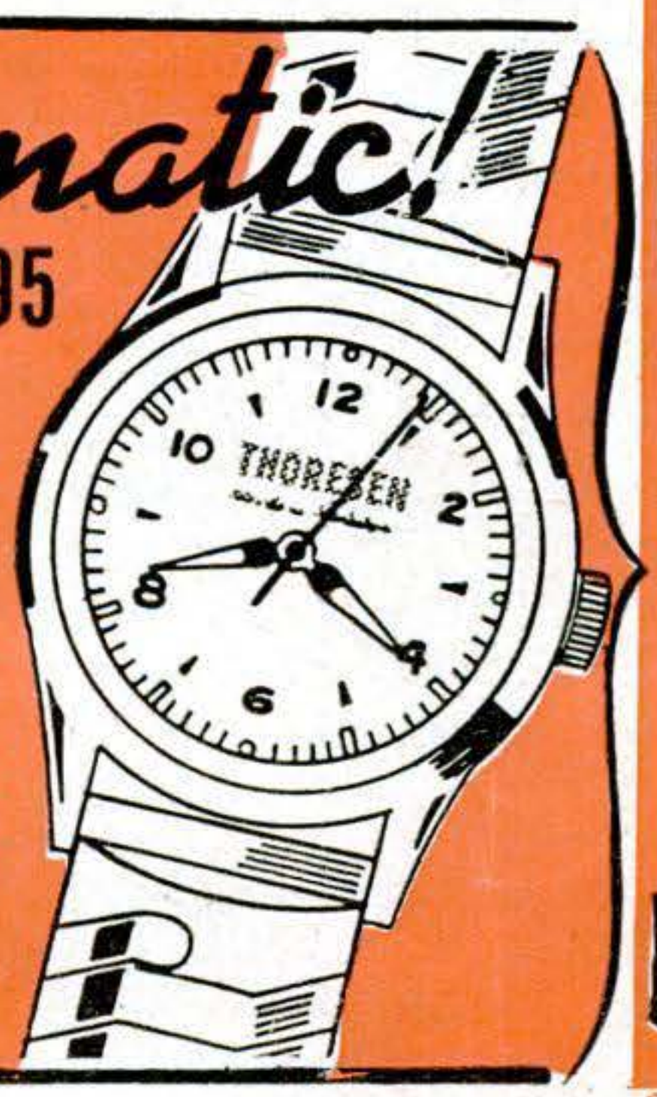

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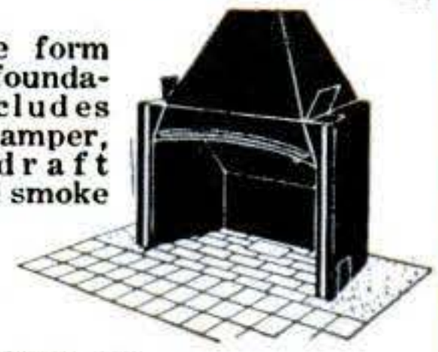
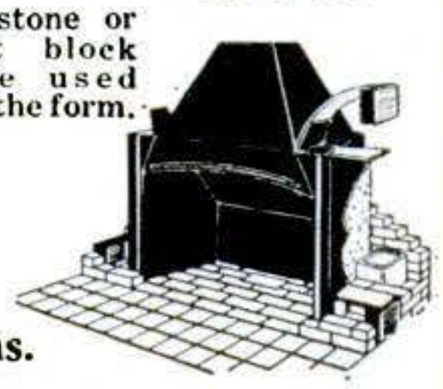


Fireplace form set on foundation includes firebox, damper, down draft shelf and smoke dome.



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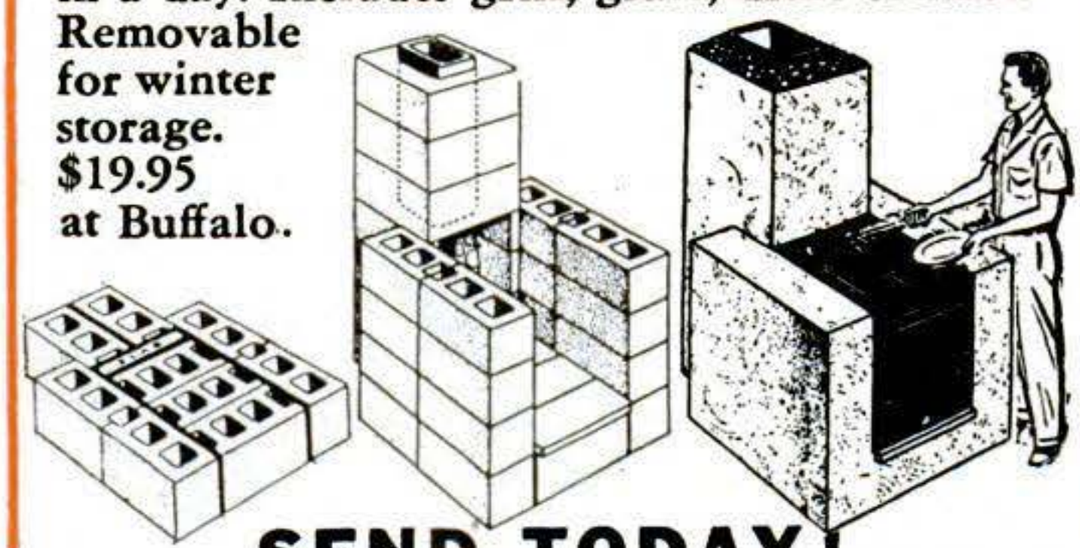

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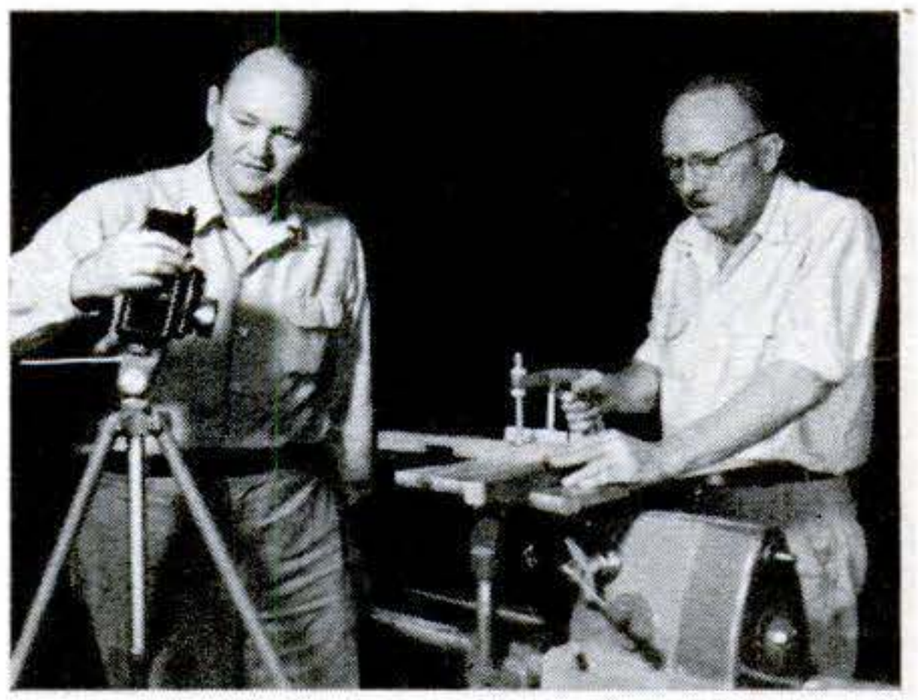

Joint Job

As a writing team, Darrell Huff (left) and Paul Corey have found that money can be made from the old saw about two heads being better than one. But their literary partnership sometimes confuses PSM editors. When we assign one an article, we never know which will sign it, or whether both will as in the case of their authoritative report about ceramic tile on page 182.

Ex-magazine editors themselves, they are now neighbors on adjoining acreage in California's Valley of the Moon, where each has housed his family in a home he built himself. (Corey's is the fourth house he has put up with his own hands.) For work, they meet in a joint workshop and photographic studio. From there come many of their how-to-do-it articles.

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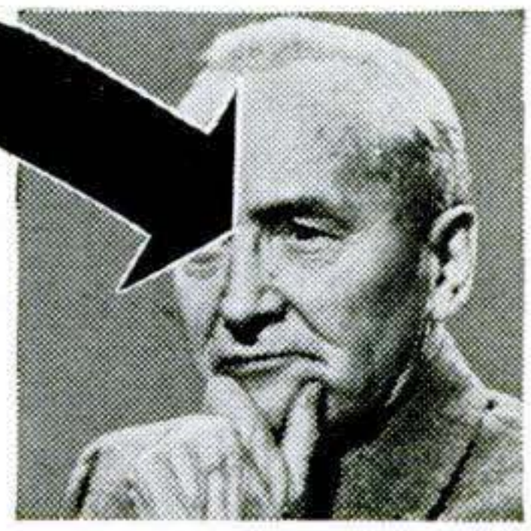

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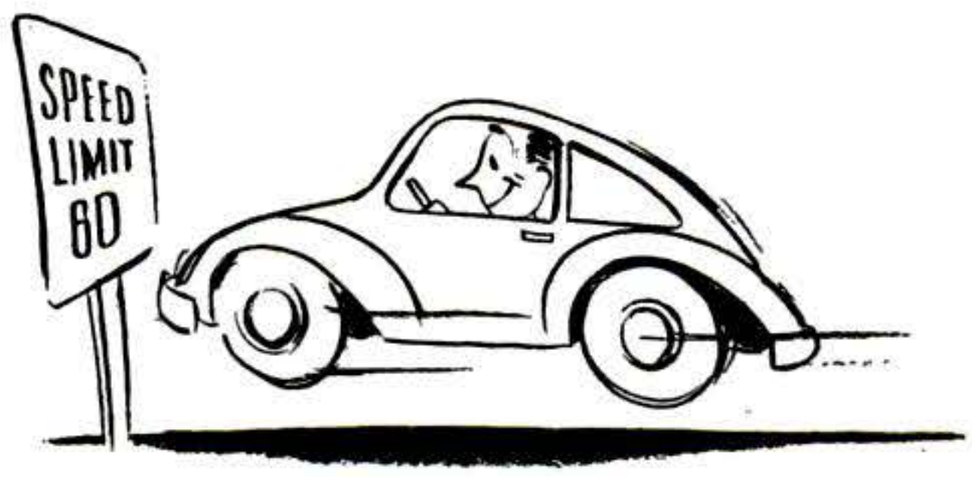
Wilbur Shaw grossly underestimates the Volkswagen in "Europe's Model A" (May, p. 108).

I recently took my '53 VW to Mexico City from Ottawa on my honeymoon. I took five days to get to Monterrey, Mexico (about 450 miles per day). At a cruising speed of 65, I got between 38 and 40 miles per Canadian gallon. On the way back, I tested the car for two days at 50 and got 50 miles per gallon on Mexican gas.

On the New Jersey Turnpike, I averaged



68.8 m.p.h., covering the whole distance in 106 minutes.

The VW is better suited to the American market than any American car is.

ALLAN WHITNEY, Ottawa

After making several 500-mile trips in my VW, I find that I am often within a car length or two of a big Caddy or Olds. Outside of occasional bursts of speed, those big cars cannot average over 55 miles an hour on good American highways under normal traffic conditions. Yet I average over 50 miles an hour on trips here in California.

BOB HELLIS, Palm Springs, Calif.

Handle with Care

Your article in April (p. 114), "Nerve Gas Now Kills Bugs," describes OMPA, Systox, etc., as "safe for humans." These organic-phosphate insecticides, like a loaded pistol, are dangerous if handled improperly. They can produce severe illness (1) by in-

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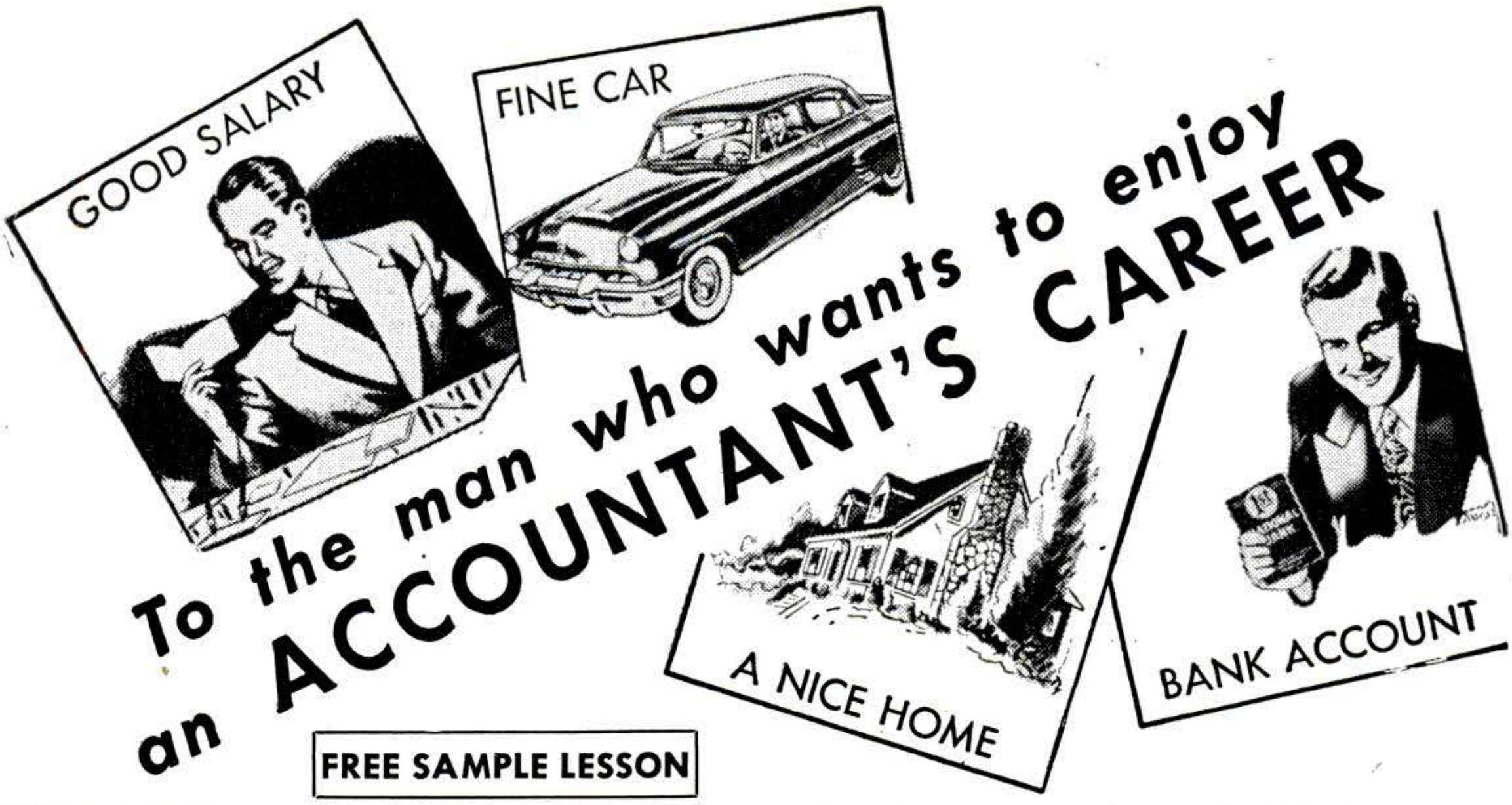

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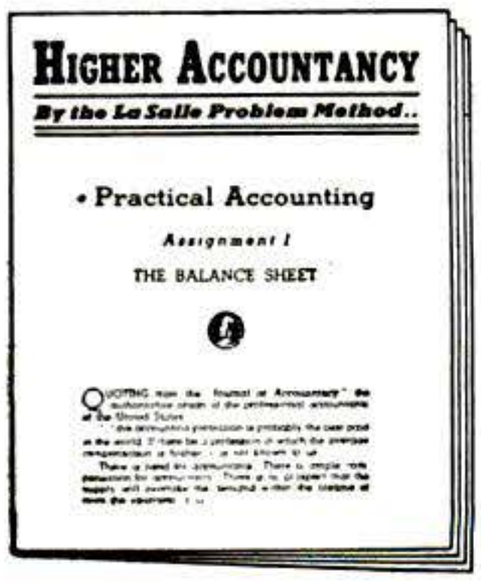

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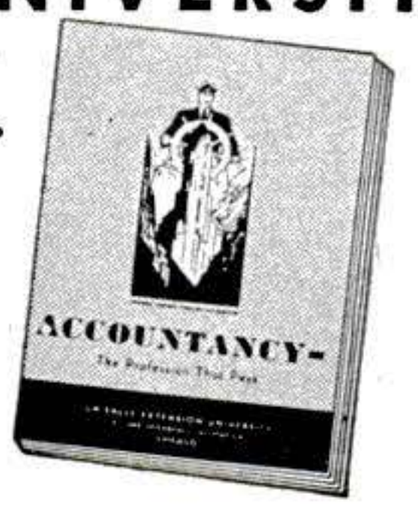

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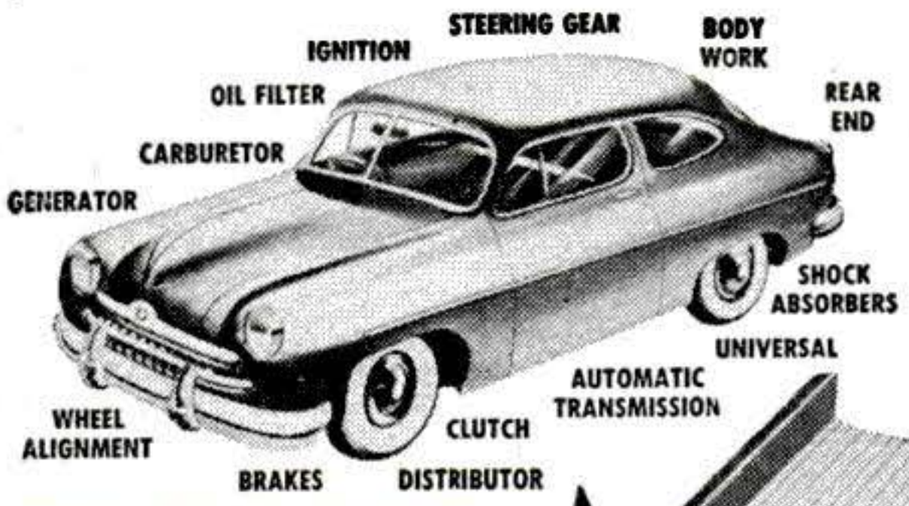

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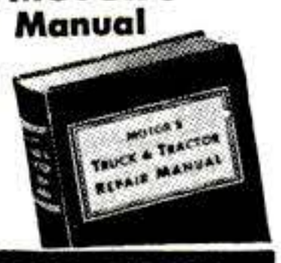

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haling the spray vapor, (2) by ingestion, and (3) by spilling on the skin. Treatment is an emergency.

Information as to the proper use of, and the hazards of, the insecticide you purchase should be obtained from the seller at the time of purchase. Read the information given on the container.

KEARNEY SAUER, M.D., Ass't. Supt., Receiving Hospital, Los Angeles

Says Dr. Robert L. Metcalf, chairman of the Department of Entomology at the University of California Citrus Experiment Station, where the new bug killers are being developed:

"When properly applied to agricultural crops at normal dosages, the systemic insecticides leave no harmful residues in treated produce . . . On the other hand, the bulk materials are among the most toxic substances known, and every care should be exercised in handling concentrates and sprays in order to prevent human and animal poisoning."

A Rocker as Firm as a Rock

My old platform rocker insisted on "walking" all over the room until I fitted the

feet with some rubber half-soles I got at a variety store. The soles were cut to shape and fastened on with the cement that comes with them.

CLARENCE R. SCHOLES, Los Angeles

In Loving Memory of a '39 Car

Why all the fuss about Kaiser-cum-supercharger (April, p. 124)?

I drove a 1939 supercharged Graham-Paige 135,000 miles. I never replaced any bearings or pistons. Had three sets of rings and valve grinds. Despite day-in-and-day-out, stop-and-go driving, the motor was still in good shape when I disposed of the car. Its cylinder walls were chrome-plated. Five cylinders were okay at the third set of rings and out .005.

This car was 15 years ahead of its time—aluminum cylinder head, dual exhausts,

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Alas, this is Alec,
whose car polish 'twould seem
Can produce nothing more
than a very thin gleam.

So when sandflies and beetles
fly onto the premise
He appears to be playing
motorized tennis.

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The easy-on wax
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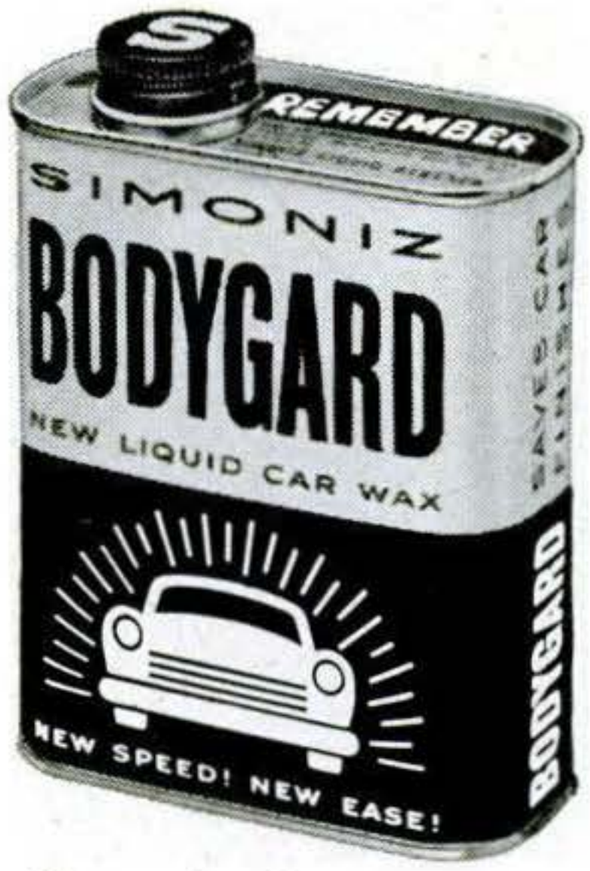

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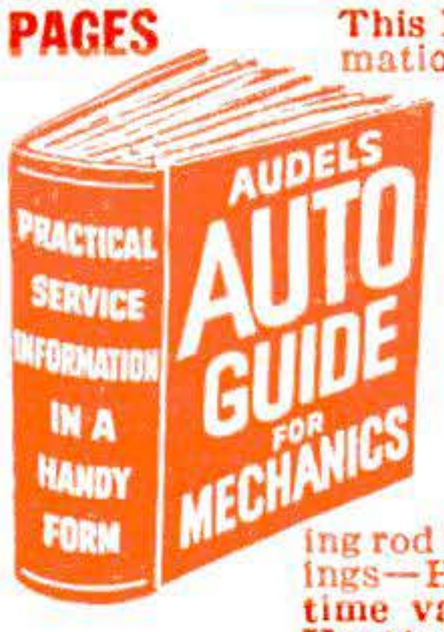

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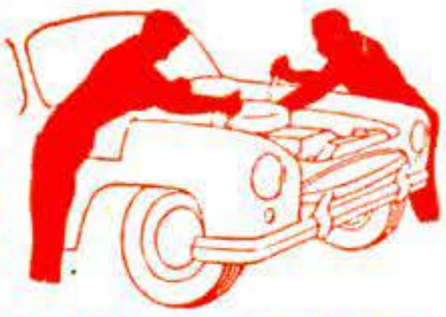

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mufflers and 110 horsepower. And it was the safest car on the road at that time or since, with a 64-inch tread, front and rear, and 8½-inch road clearance.

So Kaiser could also chrome-plate its cylinder walls and probably have the same kind of performance, with the other changes Graham had.

H. T. Yuenger, Chicago

The Boat That Cost $12 to Build

Tell me, sir, did anyone build such a boat for about $12 and in 16 hours ("A Boat That Anyone Can Build," Apr., p. 200) before the article was written?

Lumber already has cost me $63—and that's without any molding.

Nick Chicola, Olean, N.Y.

I was deeply impressed . . . I would like to compliment the author, Stanley Stearns, on an excellent job of writing.

Kent Eckhardt, Alma, Neb.

Stanley Stearns affirms that he did build this boat—several, in fact—for the price mentioned, in a small town in northern Maine, where prices are low. "I obtained my lumber from a local sawmill," he writes, "and it cost me $60 to $65 per thousand. Customers were allowed to pick out the boards themselves. I did use some horrible material from the cheaper grades, as is implied throughout the article. Lumber for the 12-footer cost less than $9."

Two quarts of cheap porch enamel, four pounds of nails and a pound of white lead added about $3.

How to Haul a Trailer

I own an 8,900-pound Stewart 41-foot house trailer, and I wonder if you can tell me what make of car, model and transmission would be best to haul it.

S/Sgt. Fred E. Putney, Shalimar, Fla.

There are as many opinions on engines as there are engine designers. But it seems safe to say that the newer OHV-V8s with a good horsepower-to-pound ratio turn in a good performance.

Transmission experts split on what's best. Some of the early automatics did poorly with trailers, mainly by foaming and oil loss on long, steep pulls. The newer automatics do better, but considerable body of opinion seems to favor either manual-shift or overdrive transmissions. With OD, you

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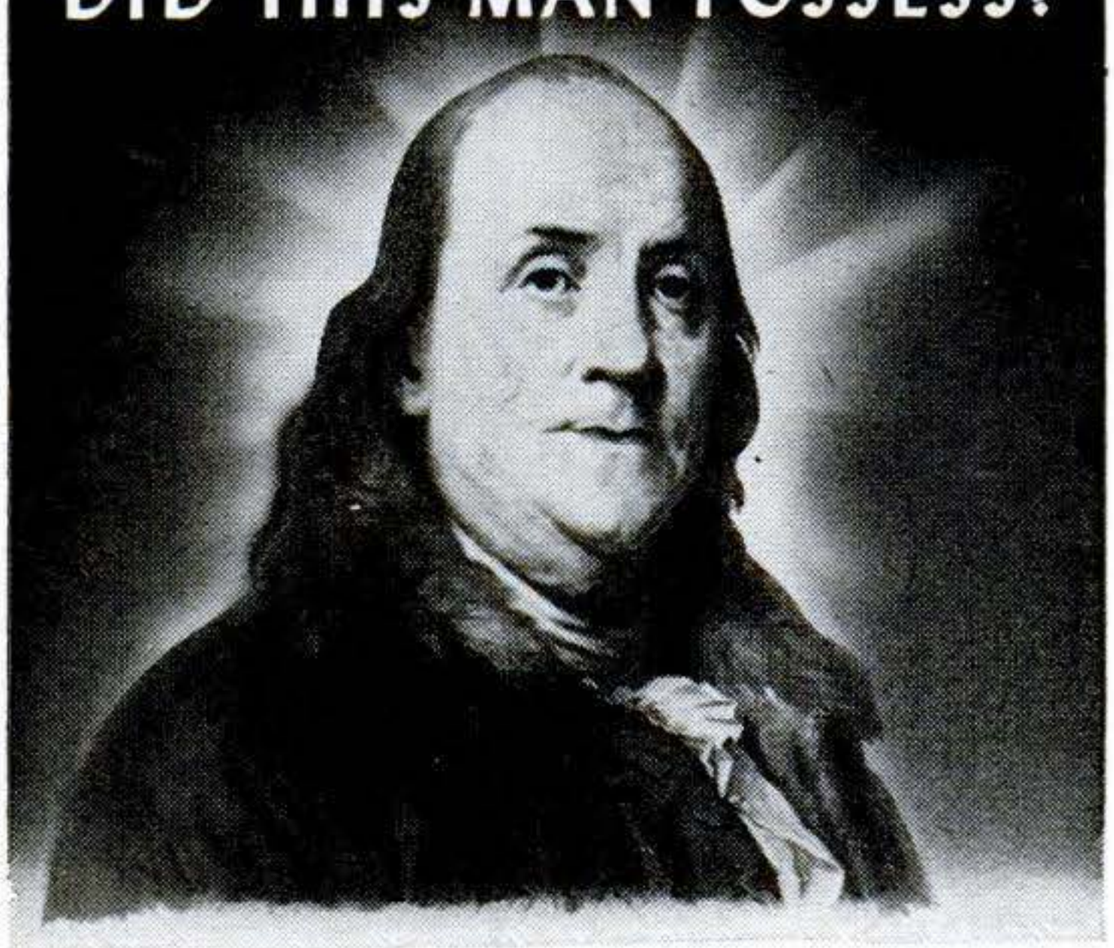
WHAT SECRET POWER DID THIS MAN POSSESS?



BENJAMIN FRANKLIN
(A Rosicrucian)

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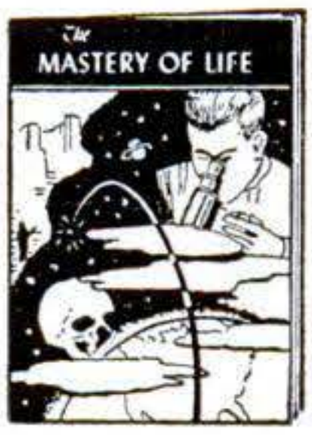

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can haul the trailer with OD locked out, thus gaining the advantage of a rear end with a high numerical ratio without being penalized when the trailer is parked.

Alarm to Expose Car Thief

About two years ago, I had a $100 shotgun stolen out of my car. In accordance with the time-honored practice of locking the barn door after the horse is stolen, I afterwards devised just such an alarm as George Walton of Pasadena suggested in your April issue (p. 154). I wired it in with the dome light in the car, so that opening any of the doors with the alarm set will start the horn blowing.

The warning device is wired in such a manner that closing the door doesn't turn off the horn. It continues to blow until

someone in the know turns off the alarm switch. This device is designed to protect the car in the absence of the owner.

I'm afraid that Mr. Walton would expose himself to a high risk if he tried the idea he proposed. The holdup man has no way of knowing that the operator can't turn off the alarm once it is set off, and he might possibly shoot the driver if his order to shut off the alarm was ignored.

EARL V. REED, Chicago

Boo-Boo, After All

You didn't make a boo-boo in the article on the new Buick (Feb., p. 146), but you certainly made one in answering S.E. Fried's letter (Apr., p. 12), when you said that the torque in his '54 Chevvy is taken by the rear springs.

The Chevvy is (and has been for years) a "hybrid," just as Fried suggested, and is a semi-torque-tube, semi-Hotchkiss drive, in which the torque is taken by the torque tube, and the thrust, or drive, is transmitted through the rear springs.

ARTHUR M. TROUT, Cleveland

Lucid Reader Trout, one of several who spotted our stumble, is of course absolutely right.

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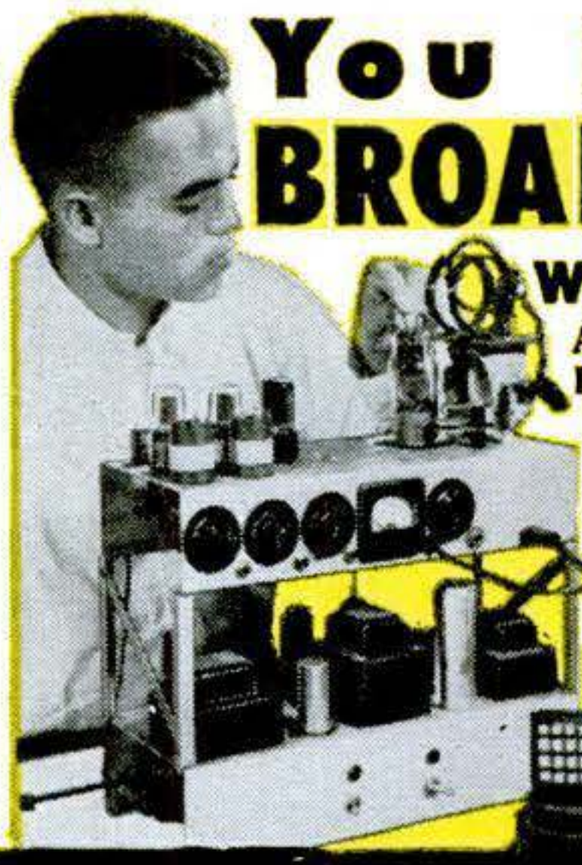

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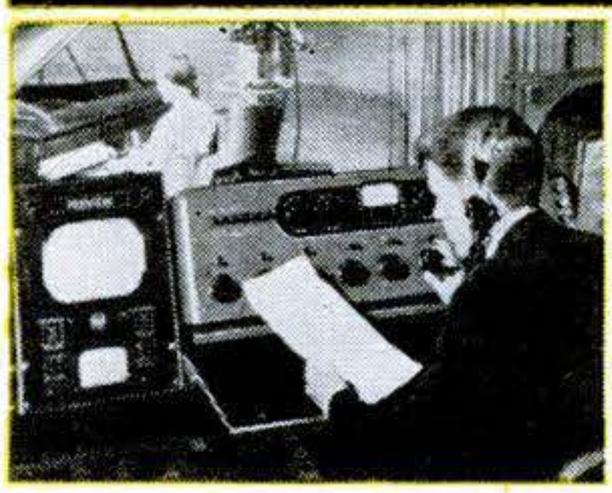

TELEVISION

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J. E. SMITH, President
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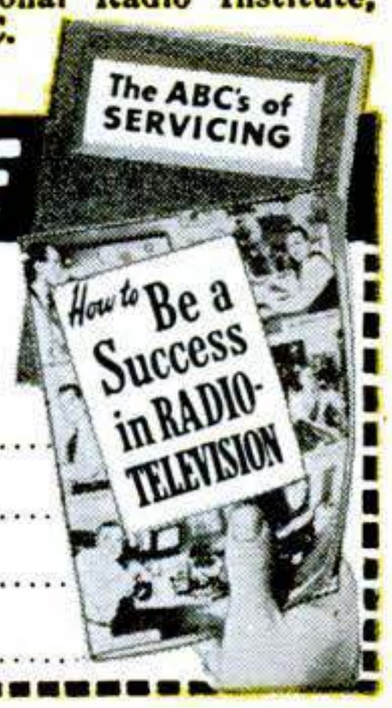

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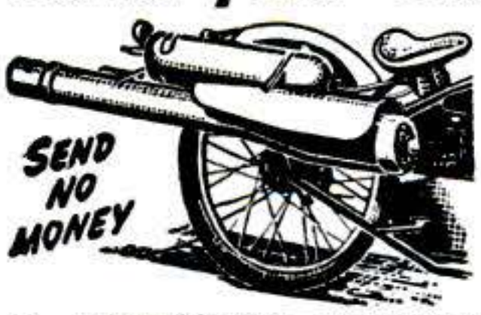

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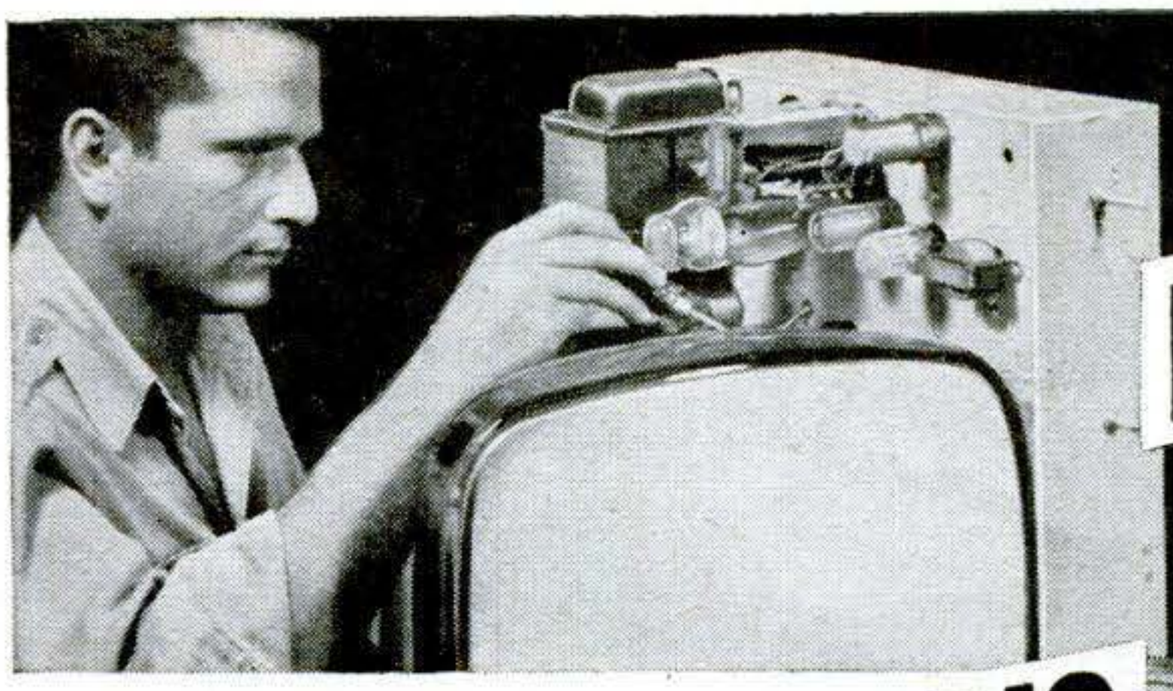

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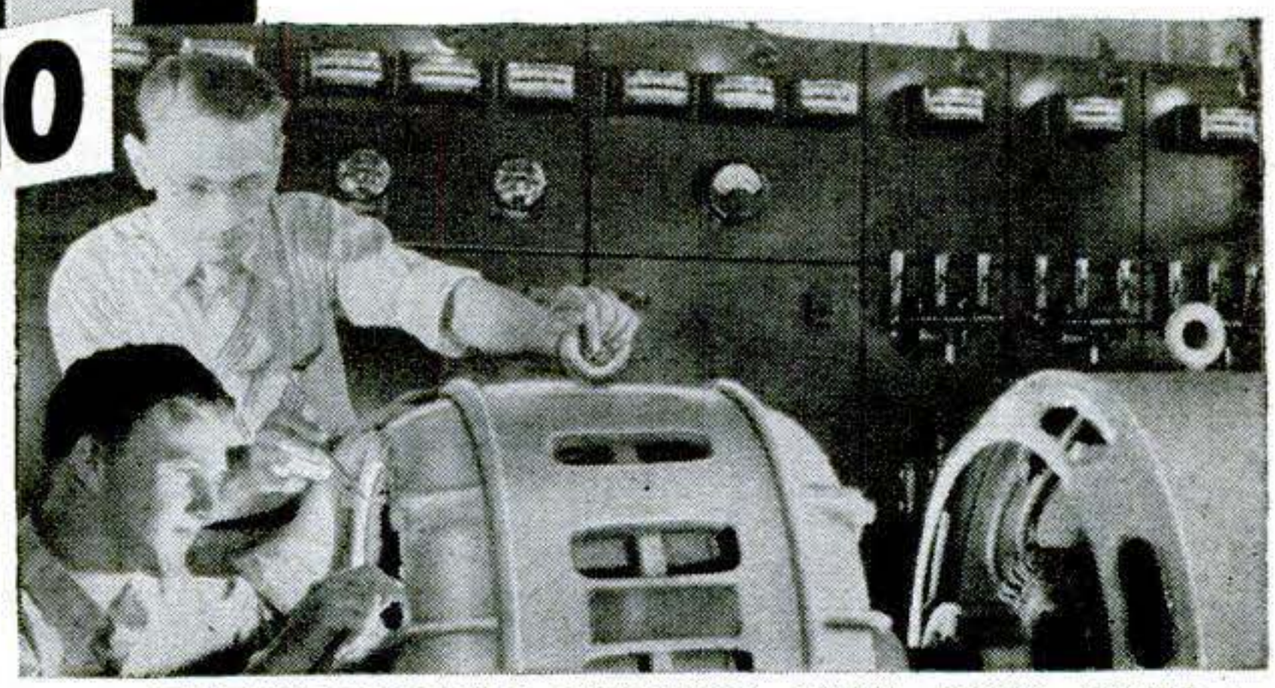

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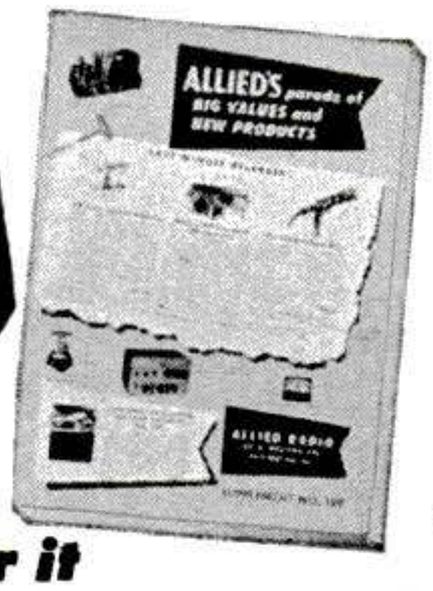

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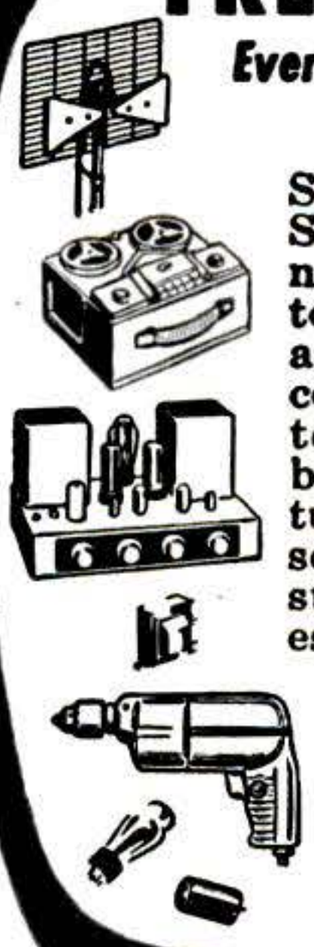

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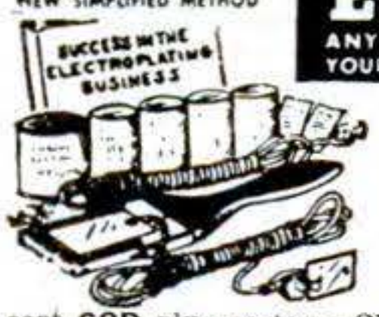

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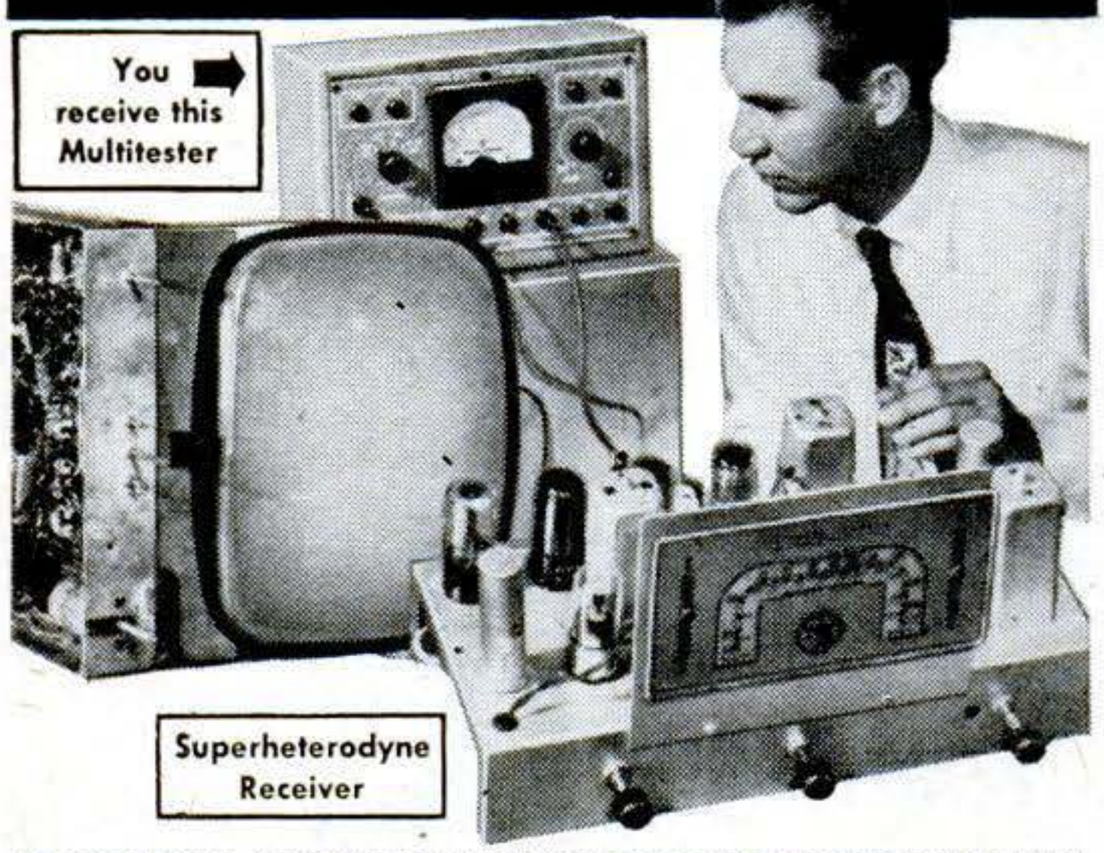

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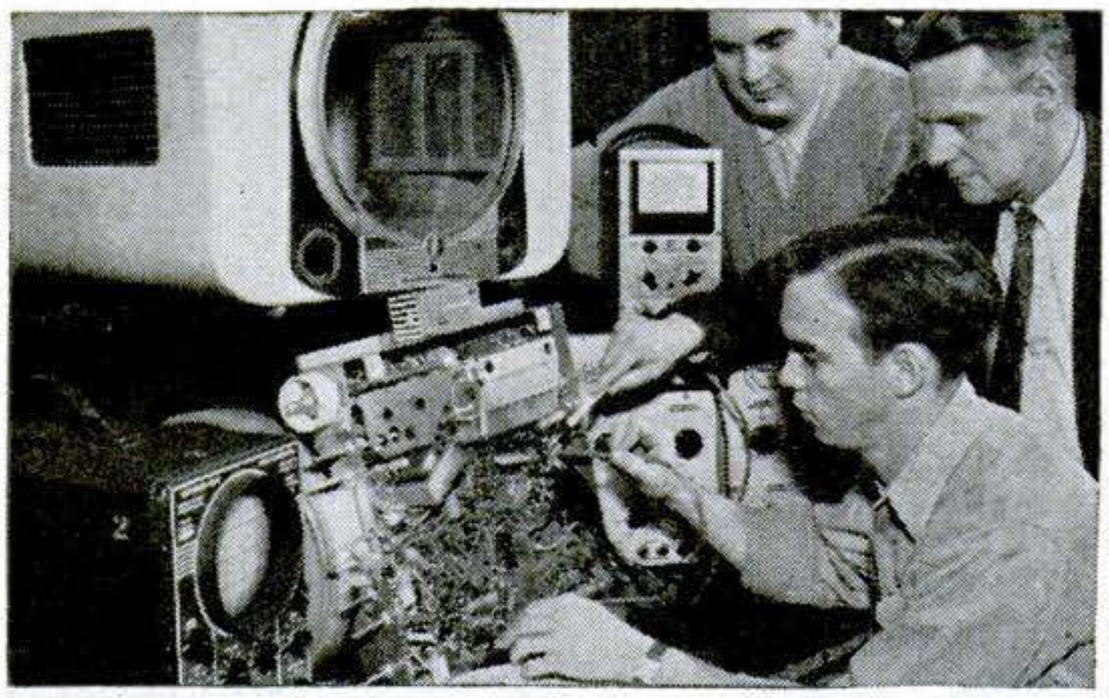

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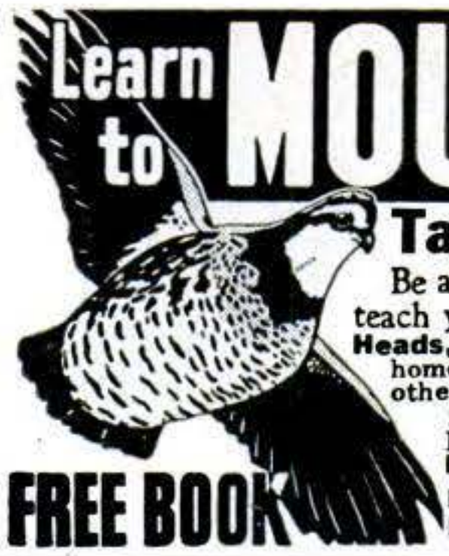

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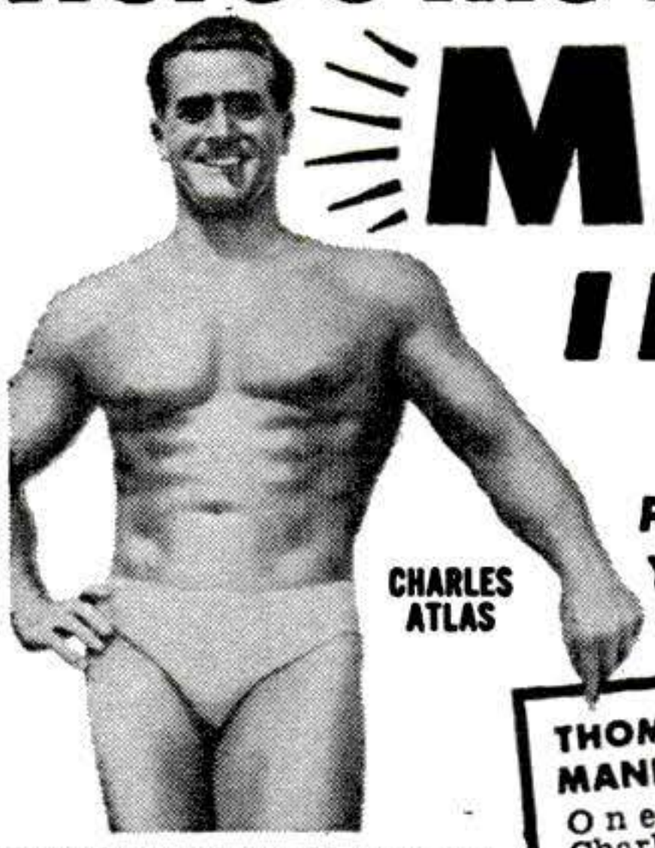

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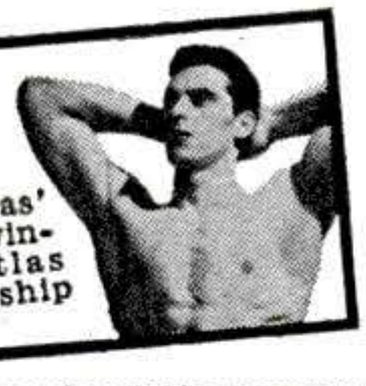

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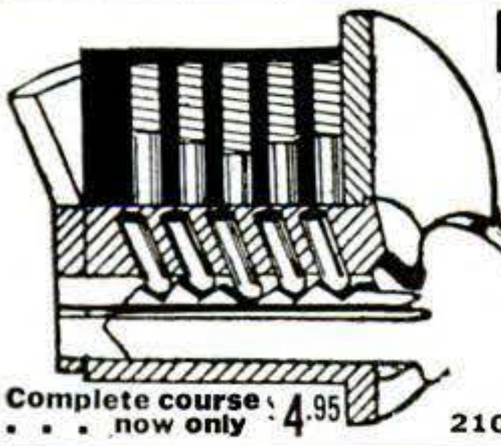

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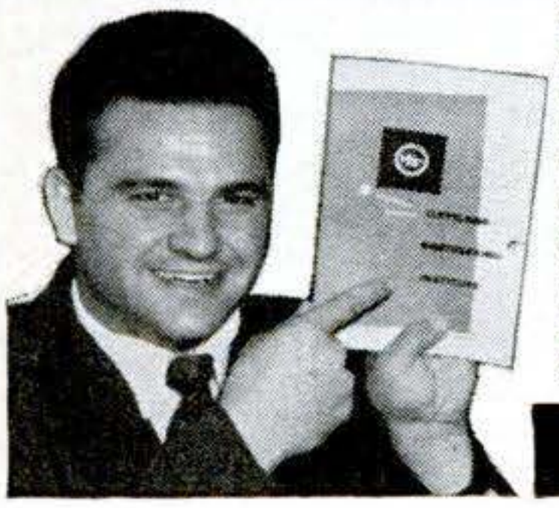

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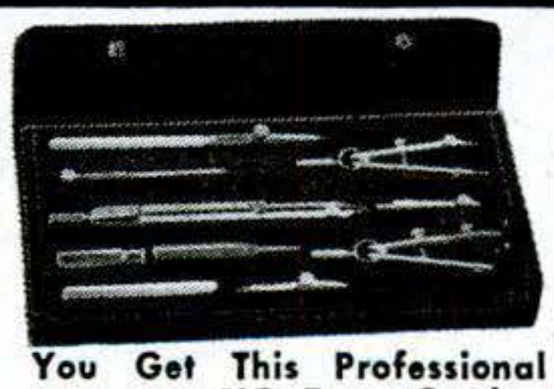

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FINANCIAL Independence by Mail Order. Details Free. Opportunities Unlimited, Dept. 3, Box 1576, Boston, Mass.

RAISE Earthworms!! Easy! Profitable! Dime brings information, unusual True Story, "An Earthworm Turned His Life." Earthmaster System, 14E, El Monte, Calif.

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$40.00 DAILY with $86.00 Sawshop Equipment. Zapart, 586-PS Manhattan, Brooklyn 22, New York.

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HUGE Profits! Operating mail order business. Write, Steinbergen, 1274-B Stebbins, New York City 59.

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BECOME A Game Warden, or join Forestry, Park, Lookout, Wildlife Conservation services. Enjoy outdoor work, good pay, real security. Complete information Free! Write "Home-Study Institute," 3156JY West Eighth, Los Angeles 5, Calif.

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$250 WEEK reported! Free book "505 Odd, Successful Businesses." Work home! Expect something Odd! Pacific-36C, Oceanside, California.

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PLASTERCRAFT molds, liquid rubber, plasters, flocks, candle supplies. Catalog and manual free. Jayhawk Plasters, Blue Rapids, Kansas.

HAVE Home Mail Business—Get $10 Orders In Every Mail—Keep $8.00. Everything Furnished. Hutchinson, 401C Adams, Dorchester 22, Mass.

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BECOME an Income Tax Consultant. Part-time Tax Experts earn to $20 an hour during yearly season, plus $2.000-$3.000 annually operating monthly Tax Service for business. We train you and help you get started. Literature free. Union Institute, Lakewood 1-L, New Jersey.

SELL To Women By Mail From Your Home—Repeat Order Merchandise. Everything Furnished. Big Profits. Mohawk, 37B Second, Amsterdam, New York.

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DO It with "Floating-Henryburgers." Over Million sold 1953, state type of place operating or occupation. "F-H" Systems, Box 936, Wichita, Kansas.

38 MONEYMAKING OPPORTUNITIES

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1930 DEPRESSION forced me to invent my own business—a minimum-cost, high-potential home mailorder. Lucky design paid immediately, over $1.000 every month since! Over half net! This original design, "Selective Mailorder," is United States Postal Service approved. Now mapped out to guide mailorder operators. Literature free. Eveningshade Ranch, Helotes 15, Texas.

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FREE! Sensational Money Making Ideas! Boyer, 65 Uptown, Hoboken, N. J.

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ILLUSTRATED Catalog: Chemistry, mineralogy, biology 20c. Tracey Laboratories, Evanston, Illinois.

CHEMICALS and apparatus for industrial, analytical and private laboratories. Catalog 25c. Dept. M-26 Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N.Y.

42 HELP WANTED

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ALASKA!! Last American Frontier. $1.00 brings 1954 Business Directory & Government Map, Military & Civilian Construction; Homestead & Highway facts; Mining, Aviation, Fur Farming, Grazing, Timber. Travel directions. List of firms hiring. How to apply. Alaska Opportunist, Box 92-S, Hollywood 28, Calif.

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KANSAS City cries for skilled, unskilled help. Help Wanted columns air mailed $1.00. Martin Supply, Tarkio, Mo.

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IS $210 a week worth a postcard to you? Then rush card with name and address for special Free Trial Plan that sells amazing new Automatic Refrigerator Defroster "like hot cakes!" Write to Mr. Lewis, D-Frost-O-Matic Corp., Dept. P-103, 173 W. Madison, Chicago 2, Illinois.

ADDRESS Advertising Postcards. Must have good handwriting. Box Nine, Watertown, Mass.

GOOD man can make $3,000 next 90 days. Every house in town wants amazing NiLite glowing curbside numbers. Automatic free trial plan pays profits day after day. Write for free details. NiLite, 173 W. Madison, Dept. 302, Chicago 2, Ill.

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MAN to earn $150 up per week. Long Needed invention. Advertised worldwide. Prospects everywhere. Full or part time. Exclusive. No investment. Free use of samples. Write Red Comet, Inc., Dept. 390-L, Littleton, Colorado.

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DRIFTWOOD Lamp Kits, complete with driftwood, brass tubing, wiring, fixtures, $5.95. No COD. Driftwood, Box 2361, Kenmore 23, New York.

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50 TOY Plans 50c. "Original Idea." Easily built using household items. M. Mascorro, 1039 Waverly, San Antonio, Texas.

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AIR Conditioners—Home or Automobile. See Seeley ad, page 252.

67 OLD GOLD, JEWELRY, WATCHES, ETC.

JEWELRY making. Send 20c for illustrated catalog. Milady-Fair Co., G.P.O. 1328, New York City 1.

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71 FOR SALE MISCELLANEOUS

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72 WANTED MISCELLANEOUS

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75 TATTOOING SUPPLIES

TATTOOING Course and Supply Brochures. 25c. Zeis School, 728 Lesley, Rockford, Illinois.

77 TREASURE FINDERS

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SCINTILLATION counters for uranium prospecting $279.95 ppd. in U.S. Cochrane Instruments, Box 71, Noroton, Conn.

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78 WATCH REPAIRING

WATCH and clock repairing books for hobbyists. Free information. North American, Dept. 24-G, 2330 N. Milwaukee, Chicago 47, Illinois.

WATCHMAKERS' — Jewelers' complete informative catalogue 20c. Bengal Company, Culver City, California.

WATCHMAKERS' Journal for watchmakers, students, hobbyists. $1.00 year. Sample copy 20c. Box 3218, Daytona Beach, Florida.

WATCHMAKERS! Beginners! Watches, Movements. Descriptive list. Box 150, Chicago 90, Illinois.

79 MISCELLANEOUS

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ADDRESS Advertising Postcards. Must have good handwriting. Box Nine, Watertown, Mass.

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LOS Angeles Remails 25c, forwarding confidential. Mercier, 835 So. Oxford, Los Angeles 5, Calif.

LETTERS remailed in Oregon 25c. Hobbyshop, Box 418, Willamina, Oregon.

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WEAR at our risk! Guaranteed wrist watch with jeweled movement and expansion band. Price $19. Send $5—balance $1 weekly. Floral Watch Co., Box 22, Glen Oaks, New York.

MEXICAN Law, General Practice Attorney, 1203 Arizona Street, El Paso, Texas.

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POPULAR SCIENCE MONTHLY'S . . . **Last-minute news & notes**

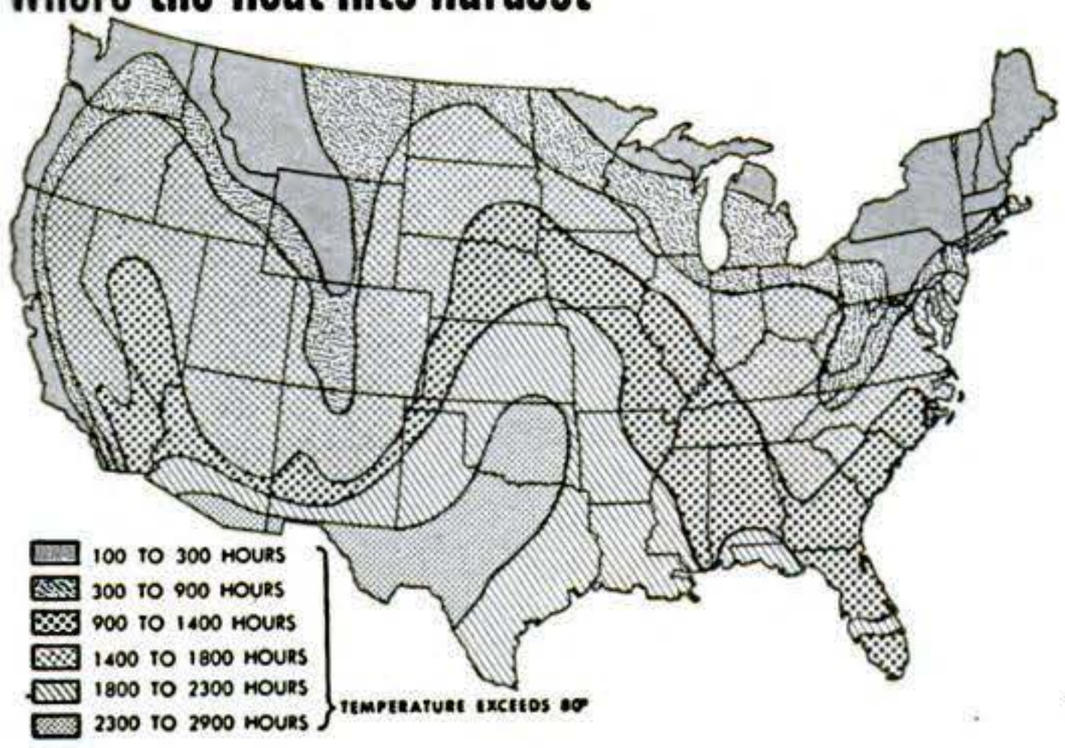
TIRES WEAR LESS ON A DUSTY ROAD, tests at U.S. Rubber show... You can get a nickel-cadmium battery for your car now. The batteries, said to last 10 to 15 years and withstand almost any abuse, are being distributed by Chrysler in six- and 12-volt types. Cost: over $100...An aircraft machine gun that fires 20-mm. shells and .50-caliber bullets interchangeably has been developed by Ford.

ADD TO THE NEW DRUGS that doctors are studying: arfonad, which reduces blood pressure so drastically that surgery causes almost no bleeding (developed by Hoffmann-La Roche)...narcotine, a cough medicine that is derived from opium but is not habit-forming (developed by Merck)...a blood-plasma substitute, known as cross-linked glutamyl polypeptide, that may be better than plasma itself (developed by Veterans Administration).

THE FIRST NEW COMMERCIAL LIGHTER-THAN-AIR PILOT IN 15 YEARS got his CAA license in Miami recently. He's Merl Brown, a blimp skipper for Goodyear...A distance record for the high-altitude research balloons called Moby Dicks was set when one launched in California was found 6,250 miles away in Spain. It made the trip across the U.S. and the Atlantic Ocean in 52½ hours, averaging 120 m.p.h.

CHANGING ELECTRICITY IN THE AIR TO MAKE PEOPLE FEEL BETTER is suggested by Prof. J. L. Worden of St. Bonaventure University. He points out that certain room heaters generate positive electrical charges, and adds: "It was known that persons in rooms so heated frequently complained of headache, nasal congestion and other discomforts." Negative charges should have the opposite effect--and tests on hamsters indicate this may be so...It'll be cooler in the cooler at Olney, Ill. They're air-conditioning the town hall, which includes a three-cell jail...Even in Maine an air conditioner will come in handy. That northern area will experience at least 100 hours this summer when the Mercury will exceed 80°, as the Frigidaire map at left shows.

Where the Heat Hits Hardest



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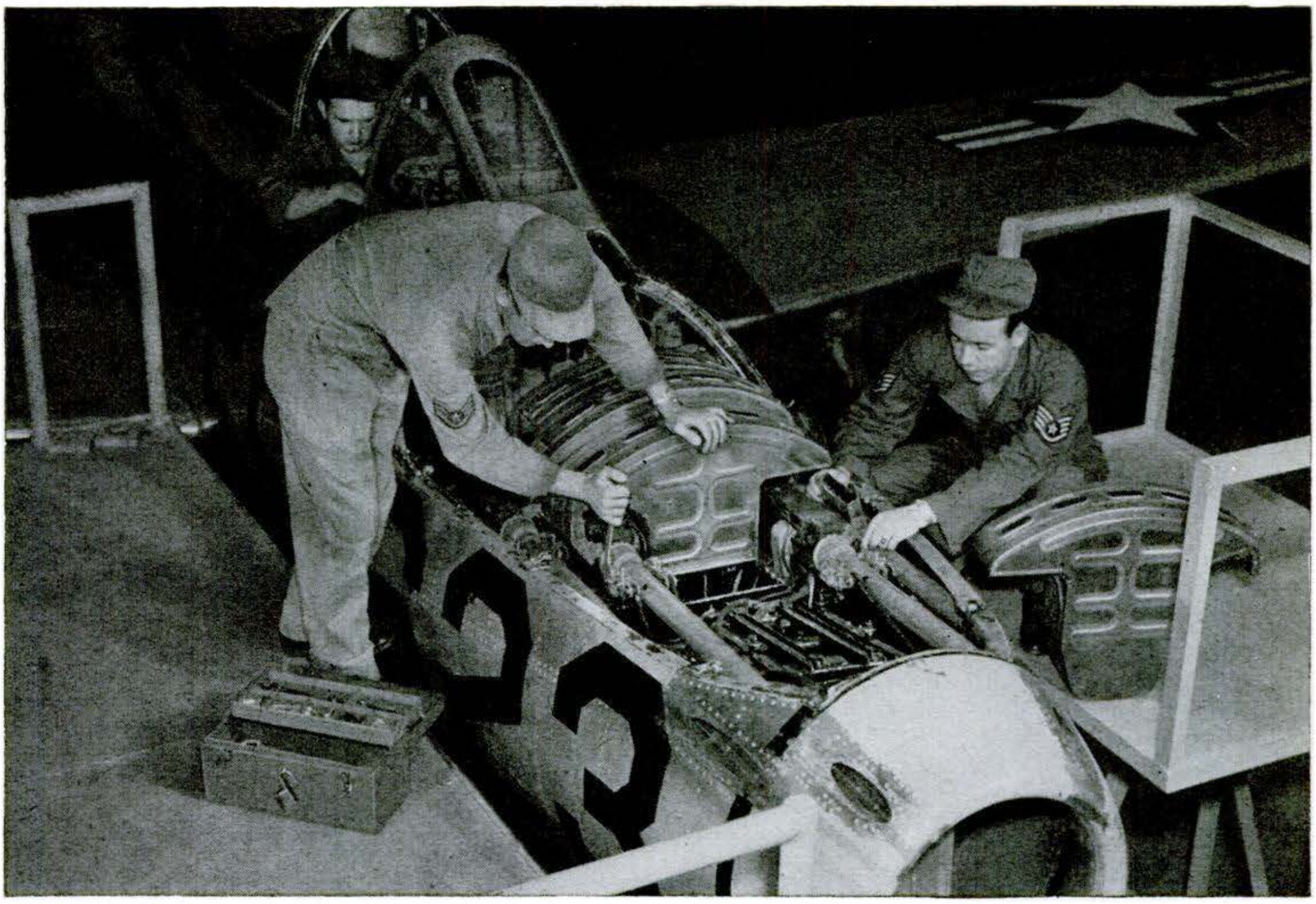

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U. S. Air Force, Washington 25, D. C.

Please send me more information on my opportunities as an Airman in the U. S. Air Force.

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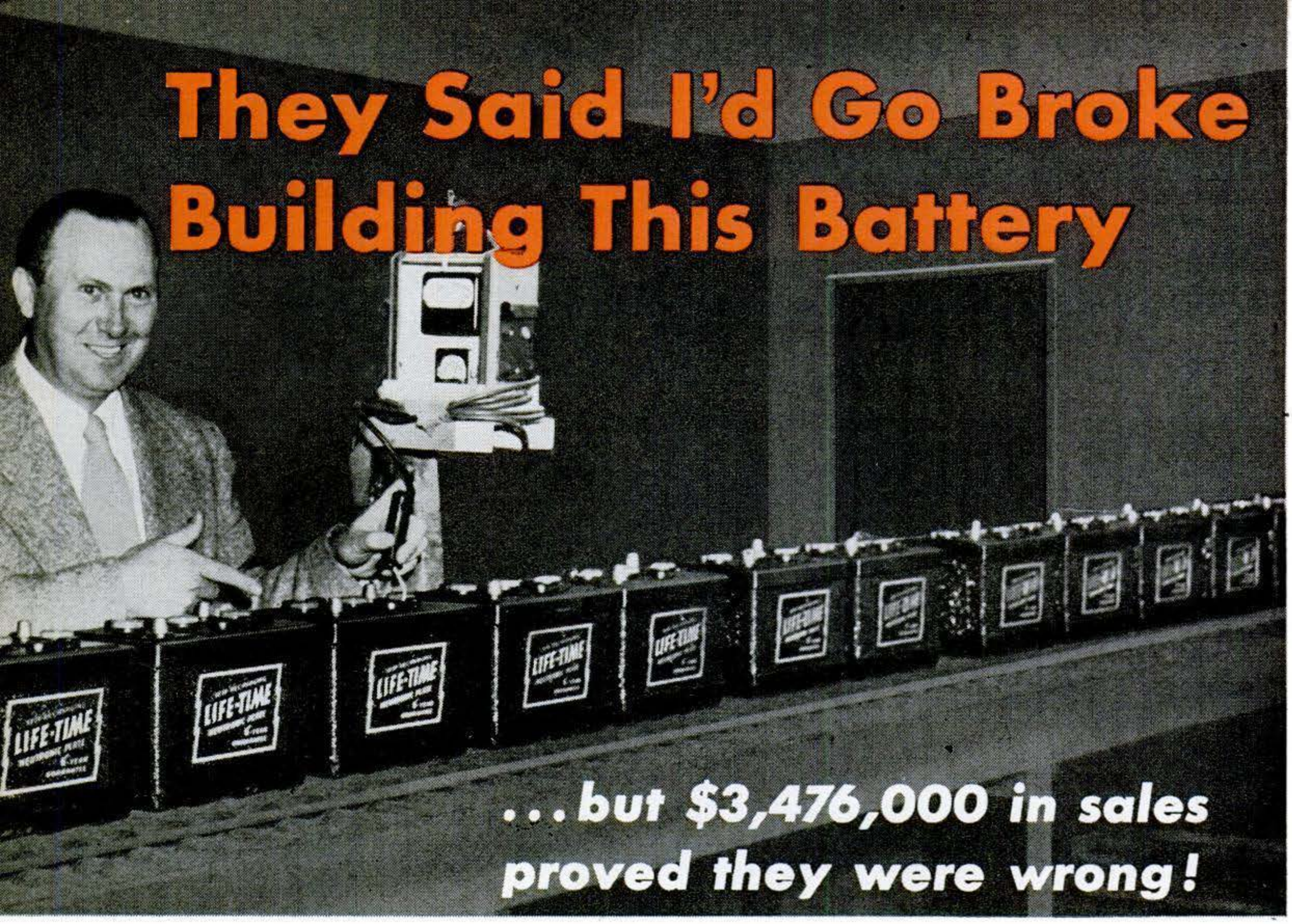
They Said I'd Go Broke Building This Battery



...but $3,476,000 in sales proved they were wrong!

by Frank E. Williams
Inventor of the Continental *Life*-Time Battery

If you've ever invented a new product, or worked out an improvement on an old one, don't be discouraged by people who say "you can't compete with big companies." Read my story. Then roll up your sleeves and get busy—it's easier than you think!

TWELVE years ago, I set out to develop an improved storage battery with the greatly increased power that I knew would be required for the cars of the future. In addition, I wanted this battery to last 4 or 5 times longer than ordinary batteries.

Like most car owners, I wondered why batteries hadn't been improved more since the days of the Model "T". First I found the answer to this problem and then I did something about it. My own belief was that many new battery improvements died on the drawing boards because of the widespread fear that they would make batteries cost too much and the belief that batteries which would last five years or more would upset part of the battery market.

The Secret of Building A Better Battery

Basically, there are only three ways to put more power into a battery:

1. Use a different metal for the plates.
2. Make the plates bigger.
3. Speed up the circulation of the electrolyte.

In my search for the ideal plate material, I reviewed everything that had been tried since Volta's original battery in 1801, including Ritter's gold-ammonia battery and Gautherot's platinum plate design invented over 150 years ago, besides plates now used in European batteries.

Working with metallurgists who had pioneered a method of increasing plate density, I decided on an alloy now known as the "neutronic" plate which combined high power output with exceptional resistance to sulfation—assuring vastly increased life.

But the big problem—the weak link that had held back battery design for many years—was the insulator that kept the plates apart. When the insulators broke down under heat and acid, the battery was doomed.

The answer, I found, was a porous synthetic insulator. Tests proved it was completely unaffected by acid, and so perfect an insulating material that it could be made considerably thinner. This left more room for plates—and thicker plates meant more power.

Moreover, the porous synthetic insulators let the electrolyte circulate more freely, keeping the battery

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cooler. This last point was actually the most important of all, because internal heat is a main cause of battery failure.

Five of our early experimental batteries were put through S.A.E tests. They were completely run down and charged, run down and charged from 604 to 1142 times for an average of 753 lives. I knew then I had a battery which could outsell anything else on the market — if I could get it on the market!

Free Advice Didn't Help

Well, I had lots of free advice from well meaning friends. Typical remarks were: "You can never market your battery even if it is better unless you have a million dollars; the big companies will run you out of business in six months; why should anyone pay more for an unknown battery even if it is guaranteed for six years?" It's a good thing I'm a hard-headed Dutchman because this just made me work harder to make my dream come true.

Let me say right now that I've had no trouble with big battery manufacturers; in fact, one of the biggest on the West Coast has helped me all along the way.

As it developed, I had plenty of time to work out production problems because of wartime and postwar shortages.

By the time I shipped the first few hundred batteries to Alaska and Venezuela for arctic and tropical field testing in 1952, one of the original *Life*-Time batteries had already lasted eleven years (and it is still in use today)!

Automotive, Scientific Editors Torture-Test the Life-Time Battery

When the word got around that the *Life*-Time battery had survived rugged field tests in the 40-65 below Arctic winter and the 100-plus Venezuelan summer, technical writers and editors started coming in to ask questions.

"Why do you call it the *Life*-Time battery?"

"*Life* because of its power, Time because of the time it will last."

"How long will it last?"

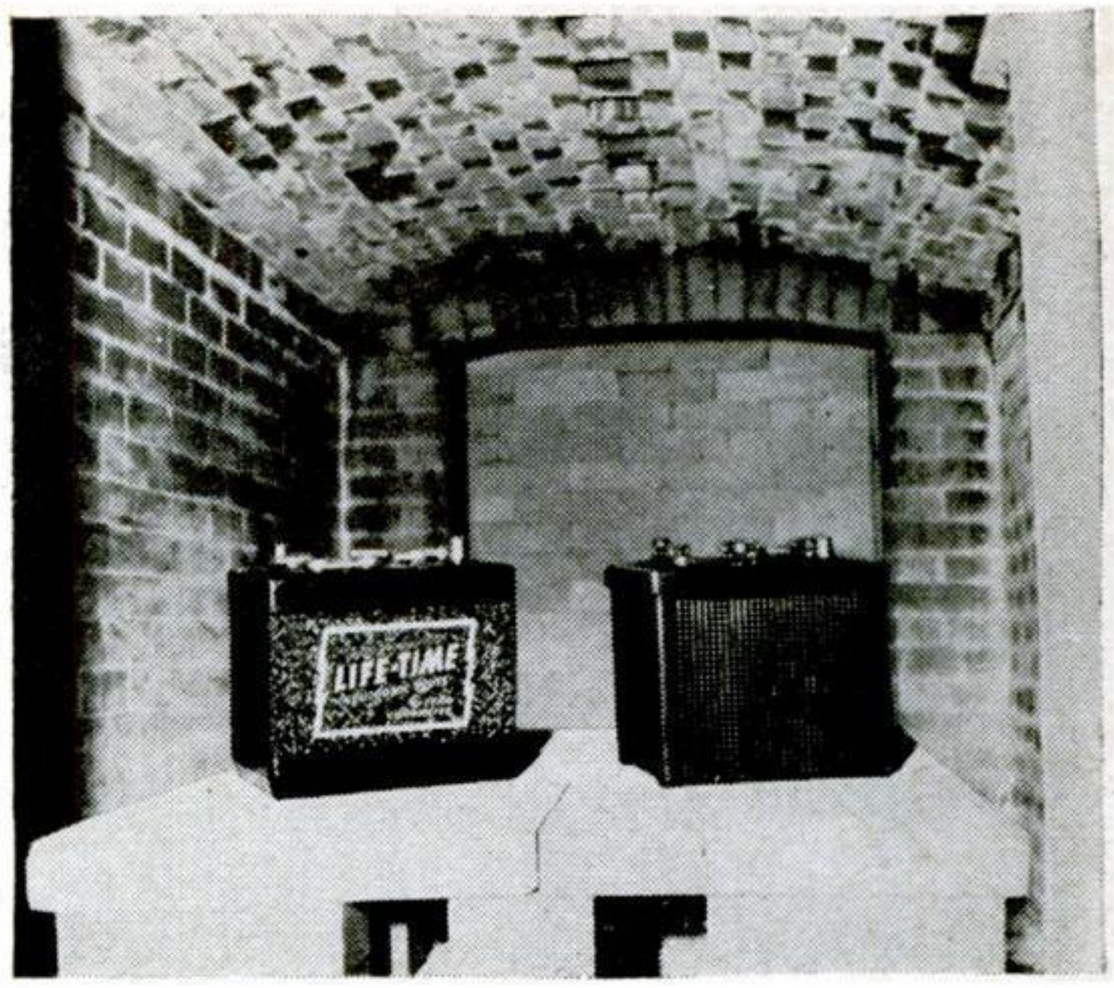
"I don't know. Ask me again in another fifteen years. I'm guaranteeing it for six years because that's a conservative figure."

When they got into technical questions about the *Life*-Time battery's construction and performance, I had just one answer: "Take a battery, test it any way you like, tear it apart if you want to."

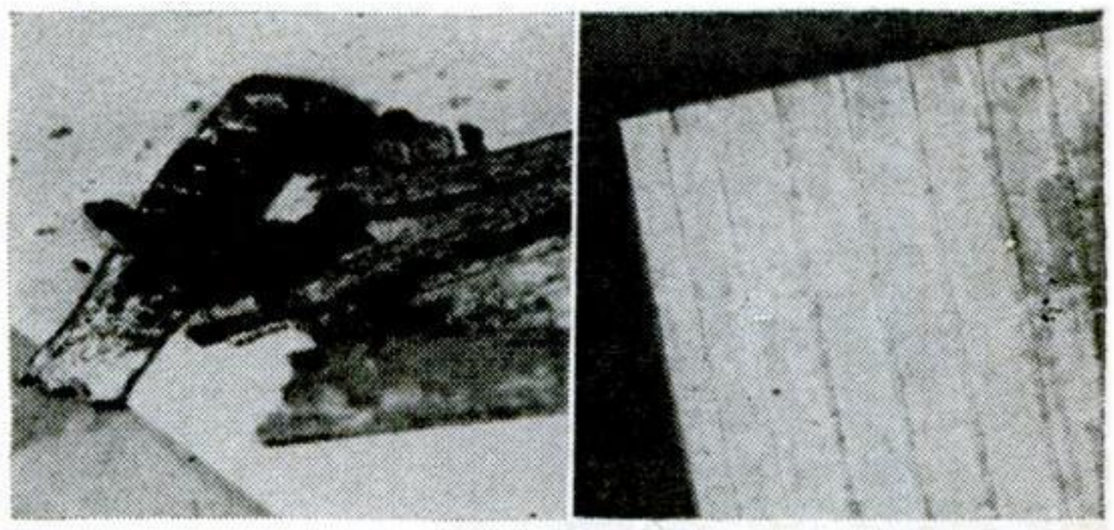
After that, things happened fast. The editors of Motor Trend magazine tested the *Life*-Time battery against two of the best-known high-quality brands, rated the *Life*-Time "outstanding... has unprecedented life expectancy."

Others editors and researchers did about everything, as one writer commented, "but throw bricks at the *Life*-Time battery trying to make it give up."

Dozens of articles were written about the *Life*-Time battery; you may have read some of them in *True, Popular Science, Motor Life, Argosy* and others.



Twin-battery bake oven test demonstrates how ordinary batteries fail when heat causes insulators to break down, plates to buckle. Improved design keeps Life-Time battery cooler, increasing power and life by maintaining higher water level.



Insulator at left was taken from a popular brand battery after one year, destroyed by heat and acid. Life-Time insulator at right was taken from a battery after five years of service.

The Experts Were Satisfied — But I Wasn't

Probably I shouldn't admit that I'm still not satisfied with the *Life*-Time battery, but it's true. Recently, for example, we started adding Tellurium to our grid metal.

Technically, it is a fascinating metal — if you can get excited about facts like these: "*...atomic number 52, atomic weight 127.5; 3 isotopes, atomic weights 126, 128, 130... hexagonal-rhombohedral prisms, isomorphous with stable grey selenium...*"

All you really need to know about Tellurium (actually, you could probably live without this information, too) is that it was discovered in 1798 in a specimen of gold ore from Austria, but nobody could find a use for it for over 150 years. Now we use it to further increase the life of *Life*-Time batteries. How much will it add to the life of our battery? Ask me again in 15 years or so. By then, our laboratories will have made still more improvements.

For construction details of Life-Time battery, turn page.

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Element protectors prevent short circuits

Double-reinforced shock-proof Catalyte Case

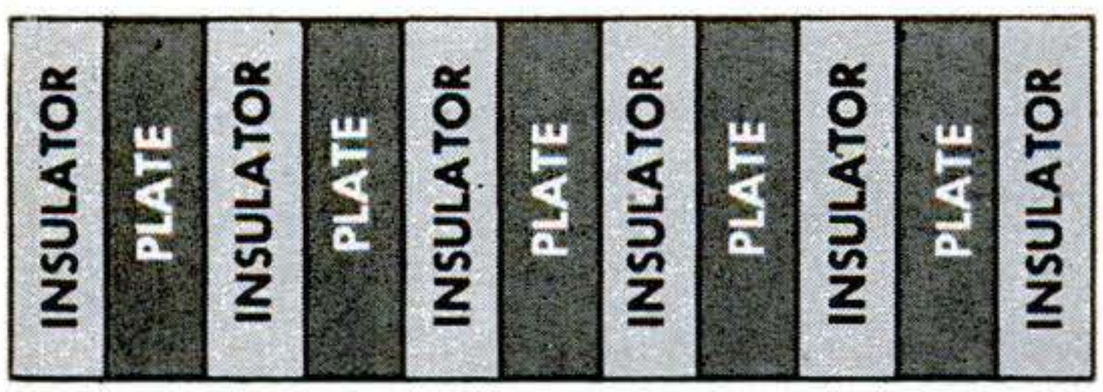
Greater reserve fluid capacity

1.260 Electrolyte protects against overcharging

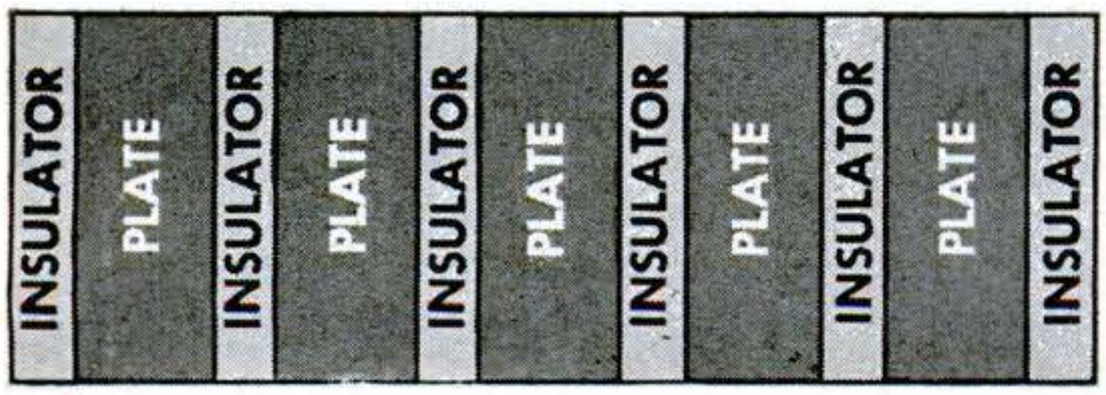
Synthetic Insulators are thinner, reduce internal heat

Thicker Neutronic Plates give extra power

LIFE-TIME
NEUTRONIC PLATE
6-YEAR
GUARANTEE



Diagrams show how thick insulators in ordinary batteries leave less room for plates. Insulators used in Life-Time batteries are thinner, making it possible to use thicker plates for more power. These porous plastic insulators permit acid to circulate freely, keeping internal heat down, increasing life.



Advice to Inventors: Don't Worry About Imitators

Naturally, the success of the *Life*-Time battery has attracted imitators to the field. By using names similar to *Life*-Time, they hope some of our success will rub off on them. Fortunately, they can't duplicate our battery, which is the only thing that counts. Their competition hasn't hurt us – it never hurts a superior product.

6-Year Guarantee Backed by Multi-Million Dollar Bonding Company

At first, I considered guaranteeing the *Life*-Time battery "for the life of the car." But since industry figures showed that the average life of a car in the hands of one owner – which is the way "life of car" guarantees are set up – was only three years, I felt I could go stronger than that I guaranteed the *Life*-Time battery for six years – regardless of how many cars you use it in.

Although I feel six years is a conservative figure – well within the life expectancy of the *Life*-Time battery – I asked one of the world's largest companies if they

(ADVERTISEMENT)

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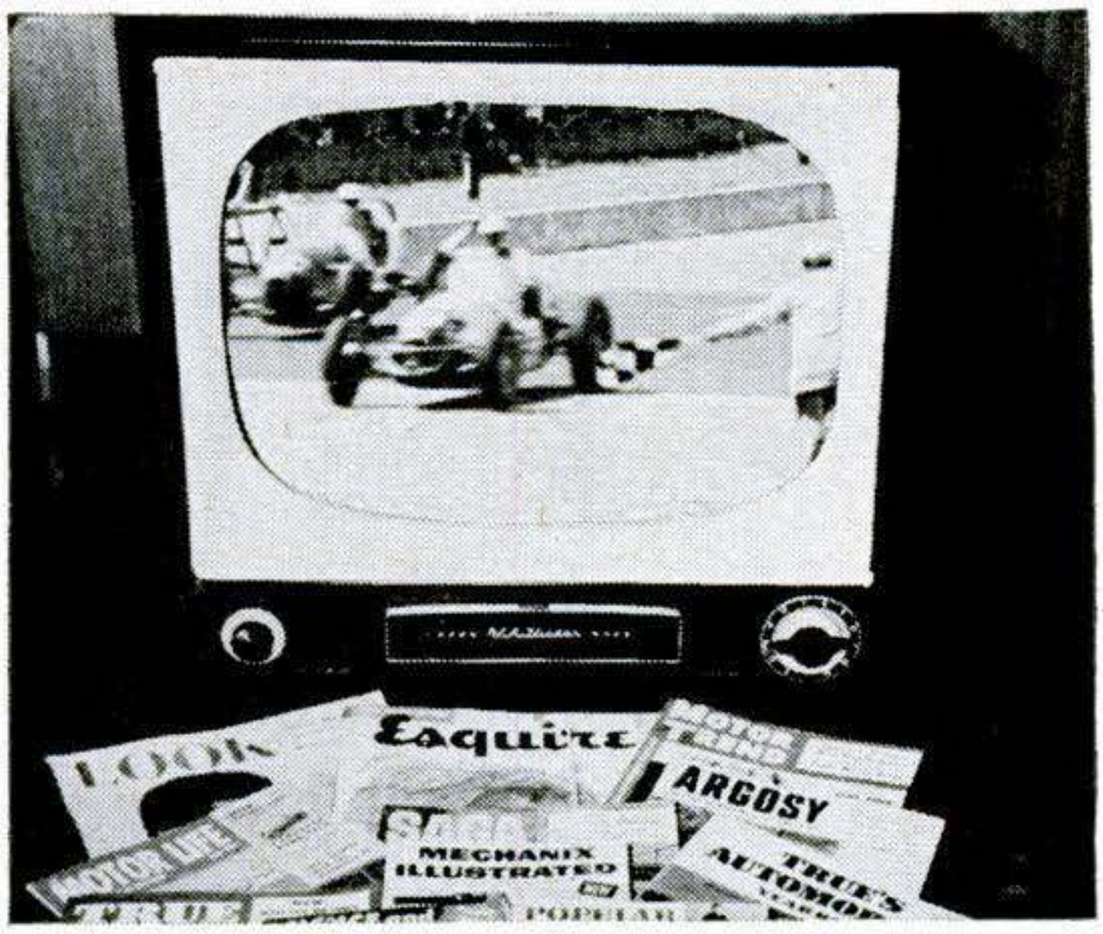

Millions read about the Life-Time battery in national magazines; millions more hear about it on network radio and TV broadcasts of international sporting events, including the Indianapolis "500" classic and Pan American Road Race.

Dealers and Distributors Needed to Fill Orders

Life-Time batteries are now rolling out of four plants, with two more scheduled to start producing this year.

If you have a retail store, such as a gas station or garage, and would like to fill the orders that come in from 4-page ads like this, plus network radio and TV broadcasts, fill out the Dealer Information Request at the bottom of this column and mail it to us.

If you have facilities for warehousing and delivering batteries and other automotive products to our growing dealer organization, write us for information about distributor franchises. These distributor franchises are not sold to anyone; the only capital required is for merchandise inventory Write:

Continental Manufacturing Corp., Dept. PS-7
Washington Blvd. at Motor Avenue
Culver City, California

Dealer Information Request

Continental Manufacturing Corporation, Dept. PS-7
Washington Blvd. at Motor Avenue, Culver City, Calif.

Gentlemen:

I have a retail business and am interested in filling orders here for Life-Time batteries. Please rush me complete information about a dealership.

Name_____

Address_____

City_____ Zone____ State_____

would back the six-year guarantee with a bond. After a thorough investigation, they agreed that six years was a conservative figure and issued the bond – the first and only time such a bond had ever been written.

One Price For All Cars

Most batteries cost more for, say, a Cadillac or Lincoln than for a Chevrolet or a Ford. This, I feel, is unnecessarily confusing to the public and to dealers who have to keep the customer waiting while they look up prices. By setting just one price for all cars, we were able to eliminate so much bookkeeping that we could absorb the additional cost of the few larger models. The full price in continental U.S. of the *Life*-Time battery is $29.95 for any six-volt size, which includes light trucks as well as passenger cars. All 12-volt sizes are $34.95. In addition, we make batteries for all farm, marine and industrial uses.

Order by Mail; Your Dealer Will Deliver

Since this is about the largest battery ad ever run, I want to try something new. I'm not interested in selling batteries by mail in competition with our 10,000 dealers, but I can do this, if you would like to order a *Life*-Time battery right now without going to the trouble of looking for "your nearest dealer," as they say in the ads.

Just fill in the order form at the bottom of this page; we'll have your nearest dealer install your *Life*-Time battery. Tell us the make, model and year of your car, enclose $29.95 for any six-volt size, $34.95 for any 12-volt size, or enclose only $5 deposit, pay balance when delivered.

Here's what you get for your money: first, higher amperage, which means more power for starting, lights and accessories; second, savings on battery replacements which can amount to about the price of a set of tires over the *Life*-Time 6-year guarantee period.

Incidentally, here's a tip about buying a battery – any battery. The best time is in Spring or Summer, because the driving you do in warm weather actually "breaks in" your battery for the cold weather ahead.

Continental Manufacturing Corporation, Dept. PS-7
Washington Blvd. at Motor Avenue, Culver City, Calif.

Gentlemen:

Please have my nearest dealer or warehouse install a Life-Time battery in my

_____

Make, model, year of car or truck

I enclose ( ) $29.95 for 6-volt ( ) $34.95 for 12-volt; there will be no charge for shipping or handling.

I enclose ( ) $5 deposit, will pay balance on arrival.

Name_____

Address_____

City_____ Zone____ State_____

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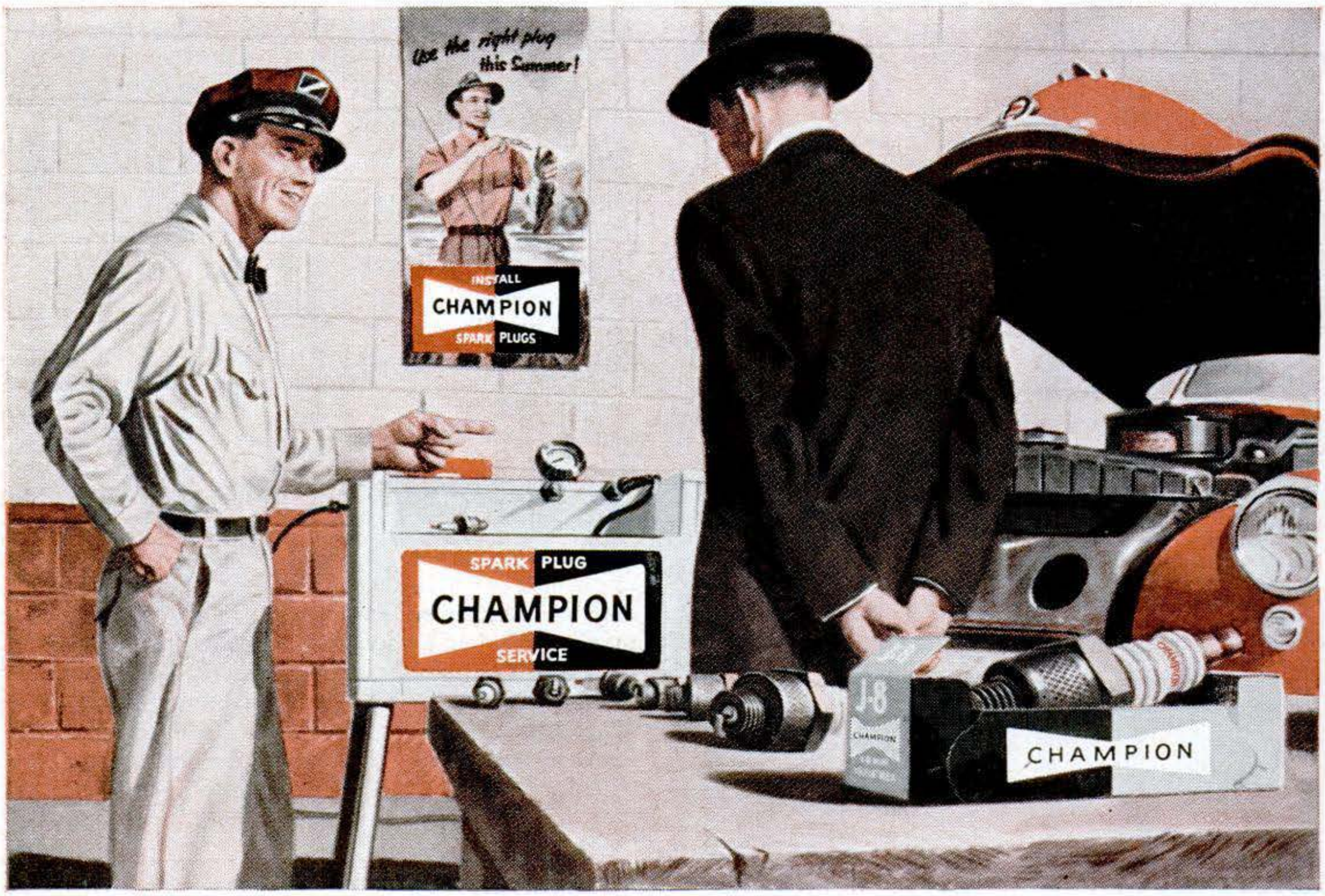
You'll See America Better If You

SEE YOUR CHAMPION SPARK PLUG DEALER FIRST



Don't let a lazy, inefficient engine take the fun out of your vacation. You've planned and waited all year for this trip . . . start right with a visit to your Champion dealer for a pre-vacation plug check

Stand by and judge for yourself as your Champion dealer rates the efficiency of your spark plugs on his modern service equipment.

He'll clean and reinstall them properly or, if you wish, install a set of new Champions.

Full-firing Champion Spark Plugs maintain efficiency under the hardest driving and provide an extra reserve of power in the tight spots. They'll pay for themselves before you're home again—in performance, economy and peace of mind.

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

Dependable

CHAMPION

SPARK PLUGS

INSIST ON CHAMPIONS WITH THE EXCLUSIVE FIVE-RIB INSULATOR!

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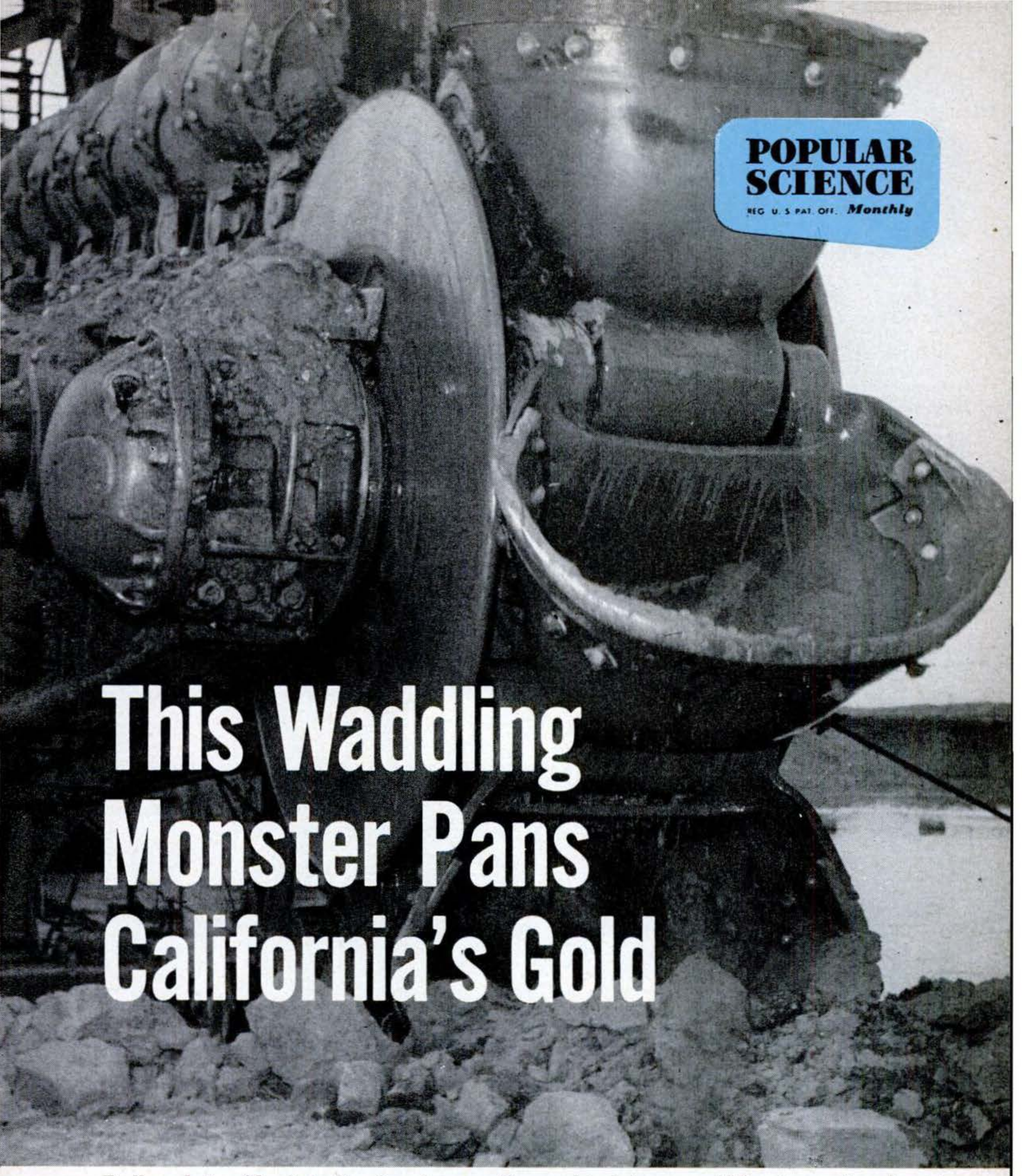

This Waddling Monster Pans California's Gold

Endless chain of buckets dips deep into muddy pond to bring up gold-bearing rock and sand.

Mammoth landlocked dredge gulps up pay dirt by the ton, sifts out metal by the ounce.

By Andrew R. Boone

YOU can still strike it rich in the placer fields of central California. But the modest grubstake that put the forty-niner and his pan in business won't take you very far today. So before the gold fever gets you, check your bankroll.

Peel off a million or more for a boat;

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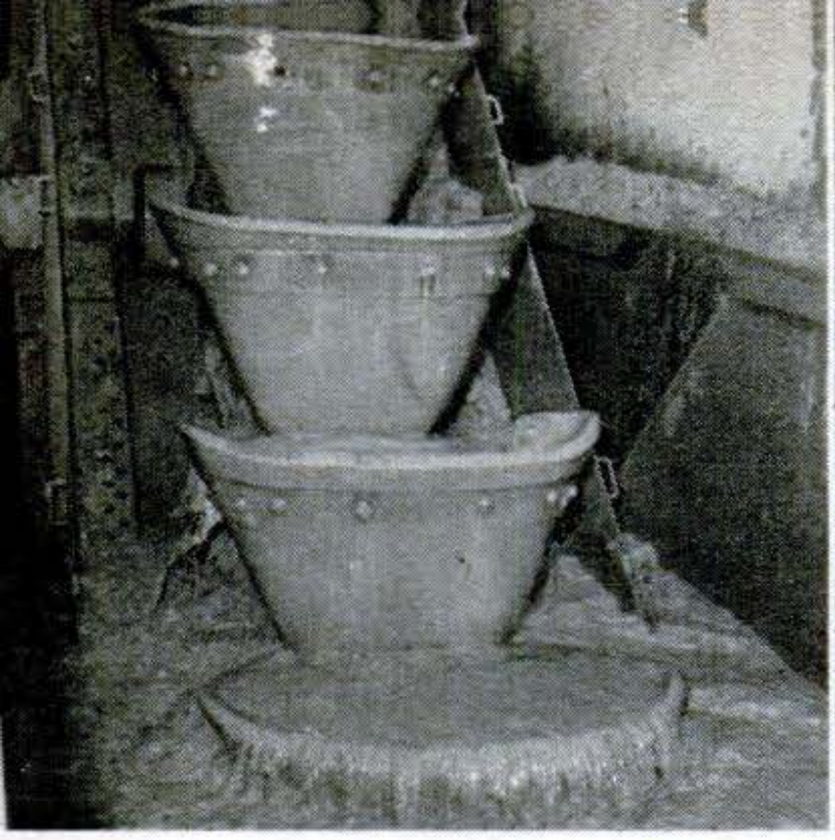
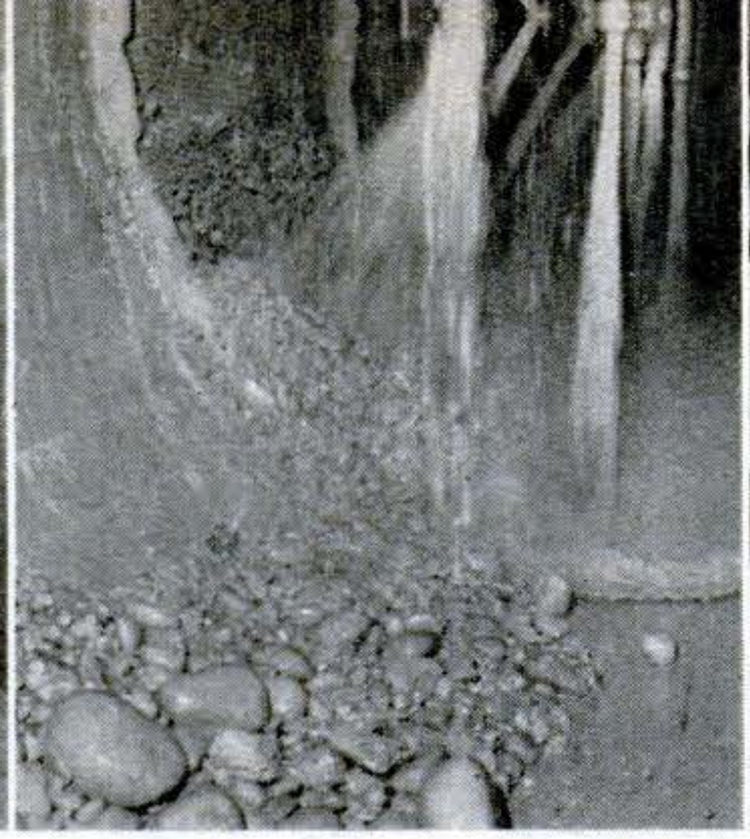
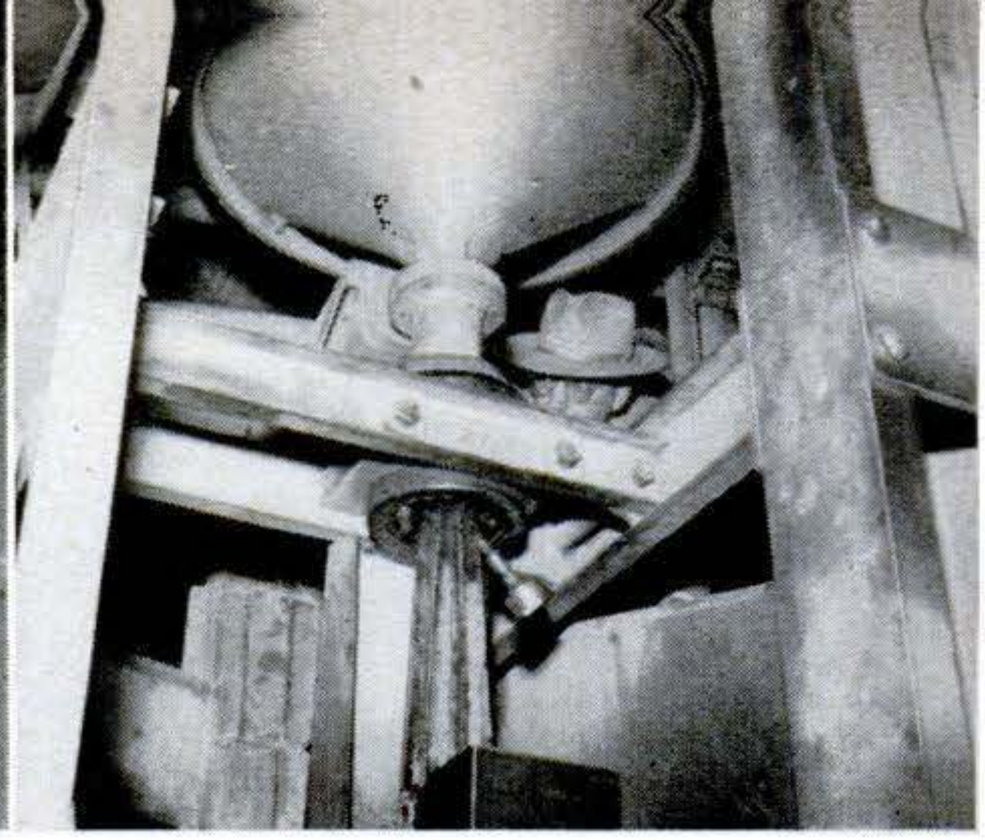


THE 900 POUNDS of muck scooped up by each of the dredge line's 116 buckets contain about three cents' worth of gold. The dredge handles 17,000 tons daily.

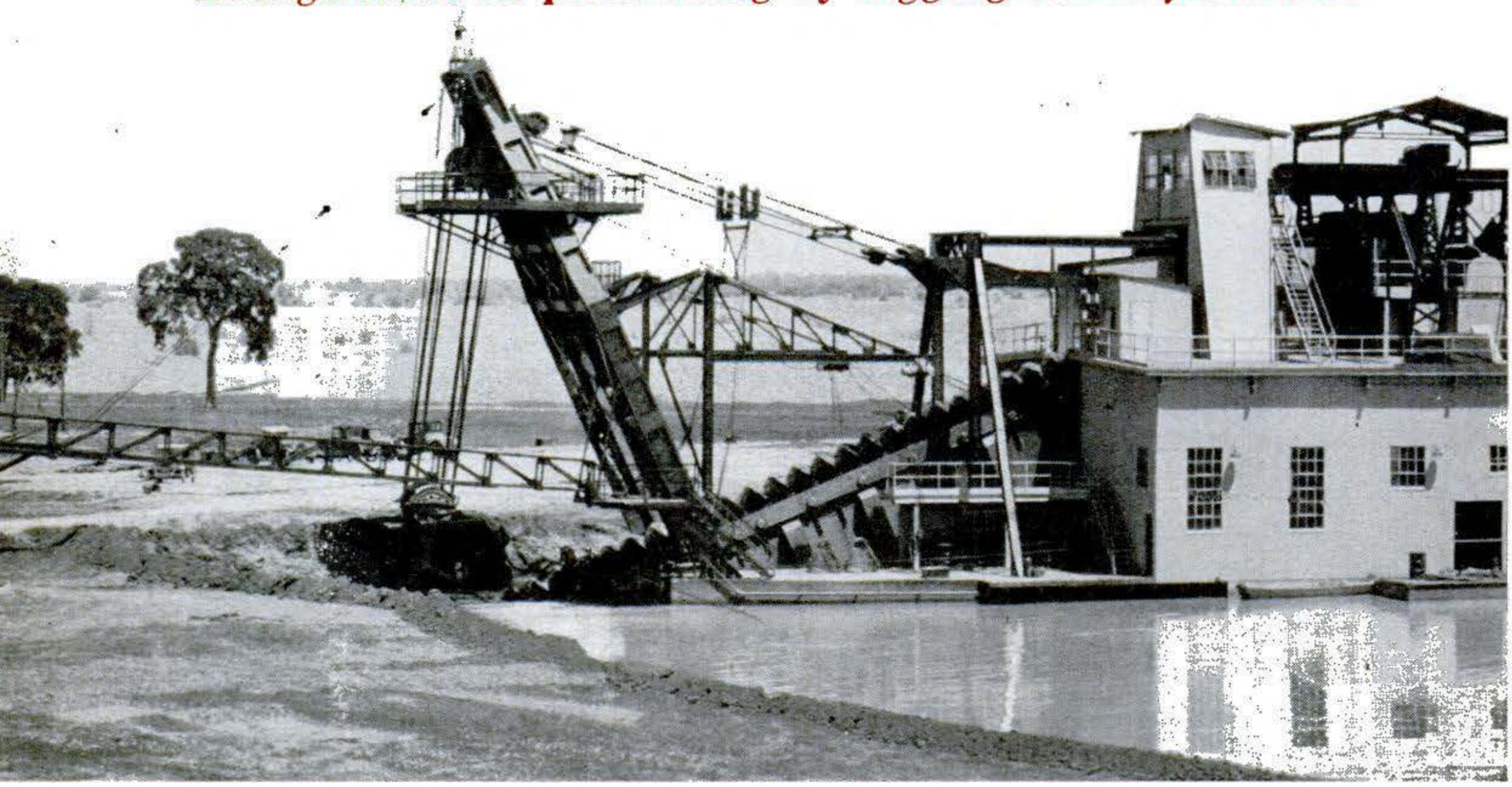


GOLD-BEARING MATERIAL is blasted by high-pressure water jet in revolving-screen drum where it is broken up. Gold sand sifts through as rocks are carried off to rear.



FUNNEL-LIKE DEVICE is a rougher jig in which gold sand falls on a bed of water and shot. A pulsating diaphragm forces the shot upward; heavier gold sinks.

Dredge takes its pond along by digging out in front . . .



although the craft is big enough for seagoing duty, you put it in a man-made pond and anchor it securely to land. Start the machinery, and the odd-looking vessel pulls itself forward at the pace of a lazy snail. Its dredging buckets gulp huge quantities of gravel, sand, rock and muck, which are spewed out as waste at the other end. Somewhere in between there will be a tiny trickle of stuff that is gold.

Such a craft is the Natomas No. 6, which I recently visited at her landlocked location 25 miles from the nearest navigable river and 100 miles from the Pacific Ocean. I was welcomed aboard by the "skipper," Burt Spalding. A bronzed little man, he was swinging a pail in one hand.

Rainbow's End: A Pot of Gold

"A week's work," he said.

I looked at the stuff in the pail. "That dirty sand?" I asked.

"About $10,000 worth of gold there."

During his 32 years of digging gold,

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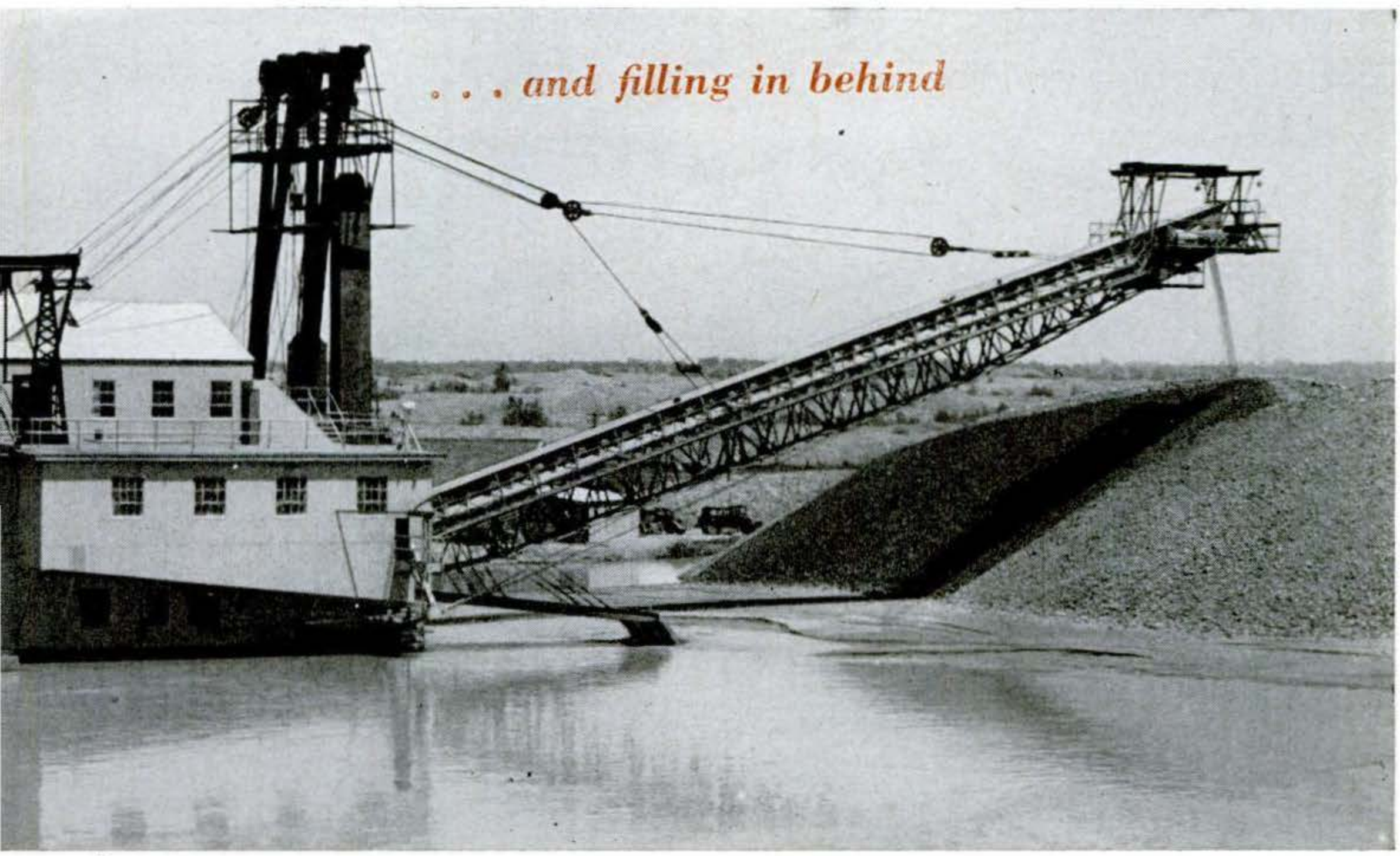
SAND leaving shot beds, still holding some gold, is carried through water pipe and dumped on recovery tables where mercury picks up more precious particles.

DREDGED MATERIAL, however, is mostly waste. Here bigger pieces of rock ride an endless belt up to a 187-foot-long stacker which dumps them on a waste pile.

PAYOFF for a week's dredging is in this pailful of "dirty stuff" that will be refined to gold—which Uncle Sam will buy and bury in the ground again at Fort Knox.



Burt has sent more than $12,000,000 worth of gold-in-the-rough to the smelters. Under his practiced eye, an endless chain of manganese-steel buckets gnaws ceaselessly at gold-bearing gravel. He has ridden these boats when, buckets snagging on rocks too big to lift, they pitched like small yachts in angry seas. He has enjoyed the placid comfort of bucketing up fairly soft sand and small rocks.

Like all gold dredges, Natomas No. 6, which measures 470 feet from the end of the gangplank to the tip of its waste stacker, was especially tailored for the job. Before construction started, a hole 450 feet wide and long enough for No. 6 to swing easily from side to side, was scooped out of the gravel. A wooden understructure was built, and No. 6 was then riveted together from steel sections. With the hole flooded, No. 6 was floated. The machinery was installed and the dredge was ready to go to work.

No. 6 will have bucketed through her innards 120,000,000 tons of rock and

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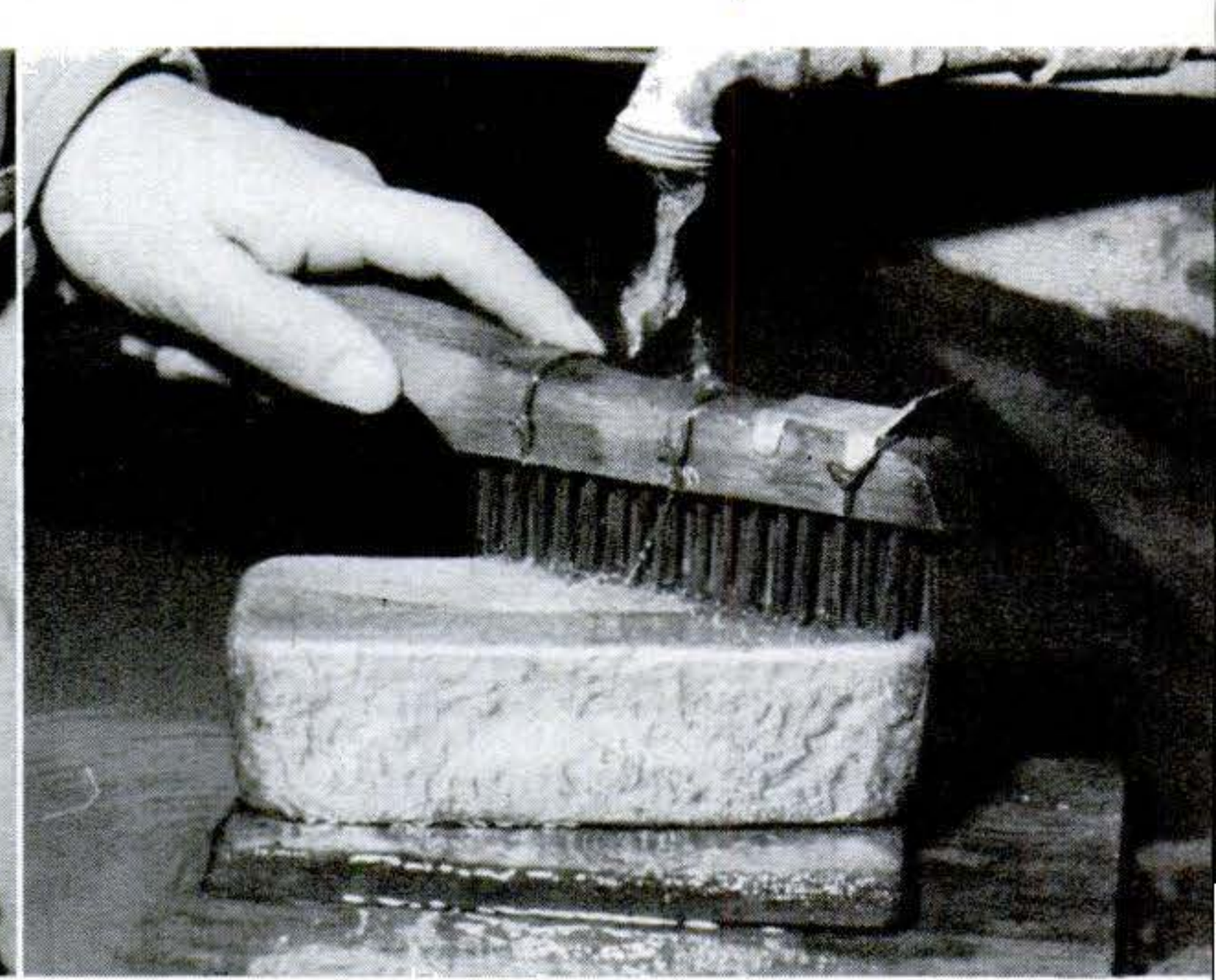
MAKING GOLD BRICKS starts with melting the dredge's pay dirt. Here gold, plus some silver and impurities, is being placed in a furnace to be melted by 2,500-degree heat.

MOLTEN METAL is poured into a bullion mold. At this stage it is 95 percent pure gold. It still has some silver, but a trace of platinum was removed in an earlier process.

WHEN BRICK has cooled slightly, it is picked up by tongs and immersed in a dilute nitric-acid bath that eats slag off the surface.



COLD-WATER SCRUBBING cleans up the ingot. With remaining dirt particles brushed off, the gold bar now glitters brilliantly.

sand before her 20-year life expectancy ends. She will have chewed paths 30 miles long. She will have been dismantled and moved twice to new, nearby locations. She will seldom push forward more than 20 feet in any day and night of squealing and shuddering. She probably will produce $10,000,000 in gold.

Digging begins at the top of the bank. As the buckets move, the dredge swings left, then right, pivoting about a 55-ton steel spud at the stern, its point embedded in the ground. The spud takes the thrust of digging. Swinging the dredge is done by pulling in and playing out anchored bow lines. To move the dredge forward, the spud is raised and another one, on the opposite side, lowered. This changes the angle of attack, and on the next swing the boat inches slowly ahead.

Panning Gold Is Big Business

Why do companies like Natomas spend millions to send these gold-panning monsters waddling through the countryside? For a single reason: the gravelly lands, though the yield per cubic yard is small, contain millions in

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WEIGHING IN at 338 ounces, this chunk of precious metal, at $35 an ounce, will bring in $11,830 from Uncle Sam. It is an average take for the dredge working day and night for 10 days. Salvaged platinum and silver is extra dividend, sold on the open market.

gold. To make it pay, enormous quantities of earth have to be moved.

To get into the business, assuming you have the know-how, you'd first have to buy or lease several thousand acres of dredging land. To find out whether your land contains enough gold to make operations worth while, you sink shafts and take innumerable drill cores. You draw maps to show the extent of the gold occurrence. Not until then would you know whether the streams that once flowed from the mountains 150 miles away had brought gold tumbling down in their beds, grinding the nuggets into fine flakes.

You should have several dredges to cut overhead. Backstopping them, you'll need a shop where machine parts can be overhauled and buckets repaired. Chances are good that you'll have to dig canals for carrying water to dredge sites. You'll need a big installation for electric power. You'll buy lubricating greases and oils by the carload.

Once you start work, you'll scarcely ever stop until the field plays out. Dredgers observe only two holidays: the Fourth of July and Christmas. END

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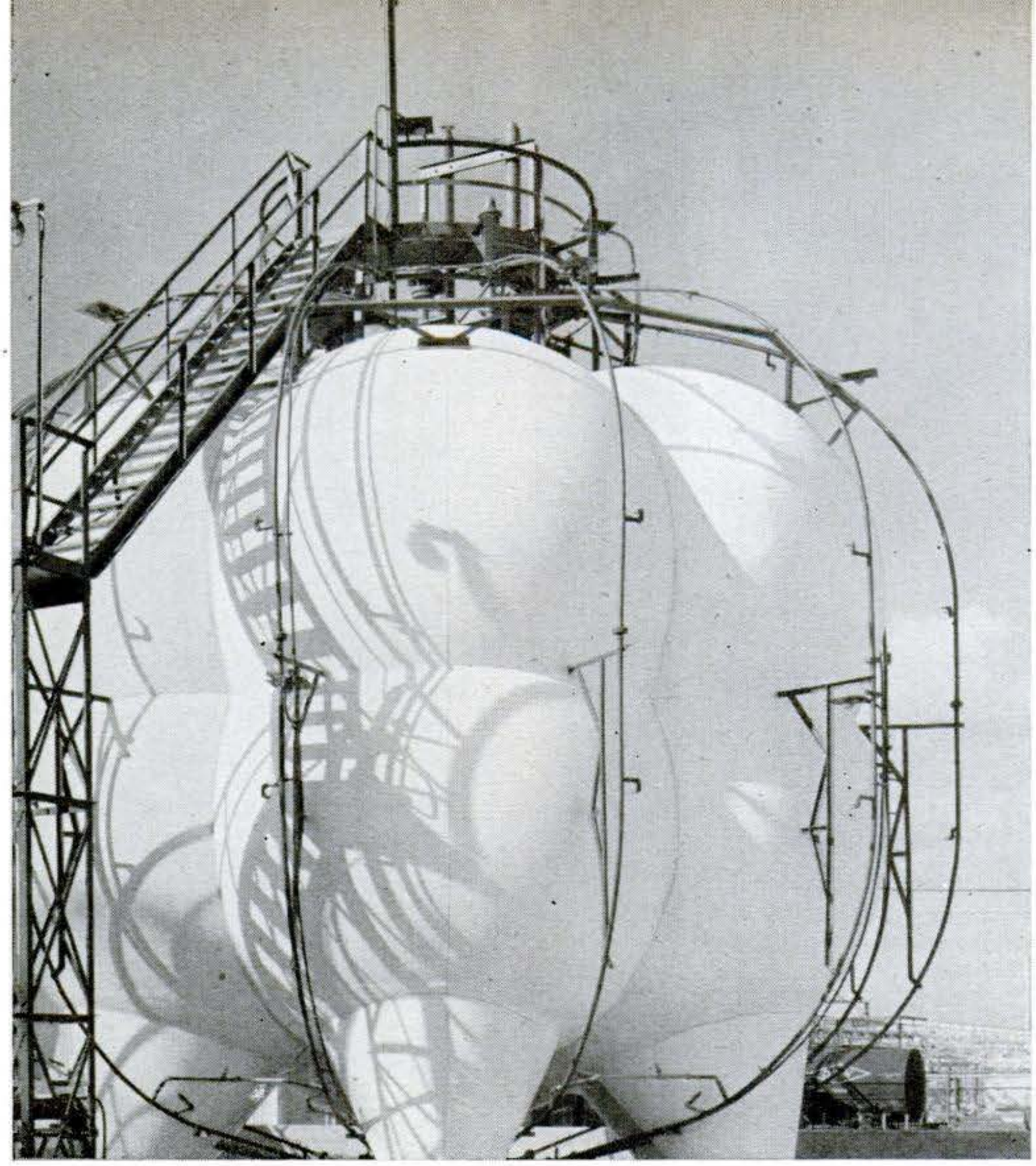


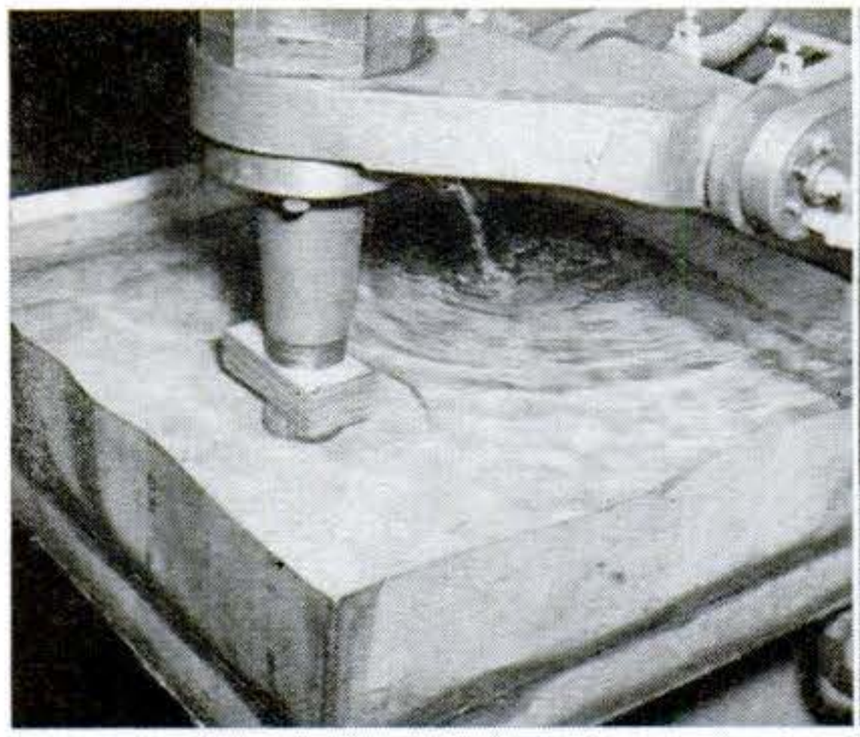
Honeycomb Gas Tank Stacks Cell on Cell

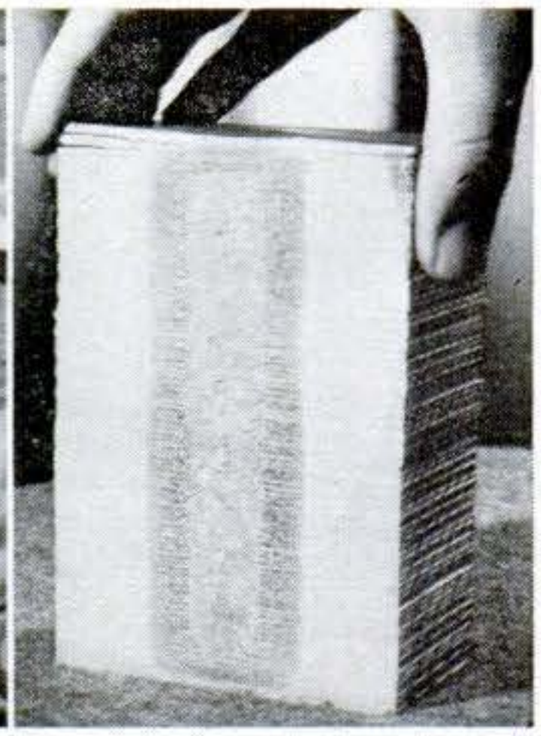
THIS lumpy monster of a tank stores 2,500 barrels of methyl chloride at a Texas plant. The 12-lobed shell is put together like a honeycomb. Openings in the inner partitions let the gas flow from cell to cell to equalize pressure throughout the structure. The tank was built for the Dow Chemical Co.

▶▶▶Are steeple jacks on the way out? A new kind of smokestack for industrial and public buildings is porcelain-enamel coated and never needs painting.

Welded Scrap Makes Bar of Scarce Metal

THIS stack of titanium sheets was spot-welded into a solid block in a tank of liquid coolant (right). The Glenn L. Martin Co. developed the process to utilize scraps of the scarce and expensive metal in the making of airplane parts.





They Say Now .....

L. L. COLBERT, PRESIDENT, CHRYSLER CORP.: *"If we have built weapons of unbelievable destructive power, we have also built machines and developed processes which can bring health and well-being to many parts of the world, and . . . serve as the most potent weapon of all in winning and keeping the loyalties of nations."*

JOHN T. RETTALIATA, PRESIDENT, ILLINOIS INSTITUTE OF TECHNOLOGY: *". . . Our battles will be won in the classrooms of our schools across the nation."*

HALL L. HIBBARD, VICE-PRESIDENT, LOCKHEED AIRCRAFT CORP.: *". . . the first nuclear-powered supersonic commercial transport . . . will fly at least two and perhaps even three times the speed of sound, crossing the country in less than two hours."*

LEWIS L. STRAUSS, CHAIRMAN, ATOMIC ENERGY COMMISSION: *"For the first time since the discovery of fire, we have . . . a force [nuclear energy] with which we can enrich our lives incalculably or, failing to make that choice, we can wreck a large part of what we have inherited from the accumulated art, heart, and spirit of the generations that preceded us."*

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The Great Windshield Mystery

By Frank Rowsome Jr.

Rumors of "disintegrating" glass spread wide. Crazed rear windows suddenly were news.

The amazing epidemic of pocked windshields seems to bear out a British scholar's analysis of "crowd behavior."

IN BARELY two weeks this spring, the U.S. epidemic of Windshield Pox flared up to a pandemic. It spread like a crown fire from coast to coast and from Canada to the Gulf.

In small towns and large cities alike the pox followed a typical pattern: it would hit town overnight, rage unchecked for four or five days, and then sweep on elsewhere. The classic symptom would be tiny pockmarks, ranging in size from a period to a dime, on car windshields. Occasionally whole panels of auto glass would craze all over.

One observable oddity was that, once the first rush of the pox was past, the number of new cases would drop off to zero almost overnight. Matter-of-fact people blamed kids with BB guns, or psychos with homemade pellet projectors, or defective glass, or unusual weather. More imaginative heads put it to radioactivity, vibration from supersonic planes, unfriendly acts by flying-saucer personnel, and tiny, glass-eating sea animals blasted up out of the Pacific by H-bombs. A few calm voices put it to hysteria—a notion that tended to empurple car owners who had found tiny pits in their own windshields, or who

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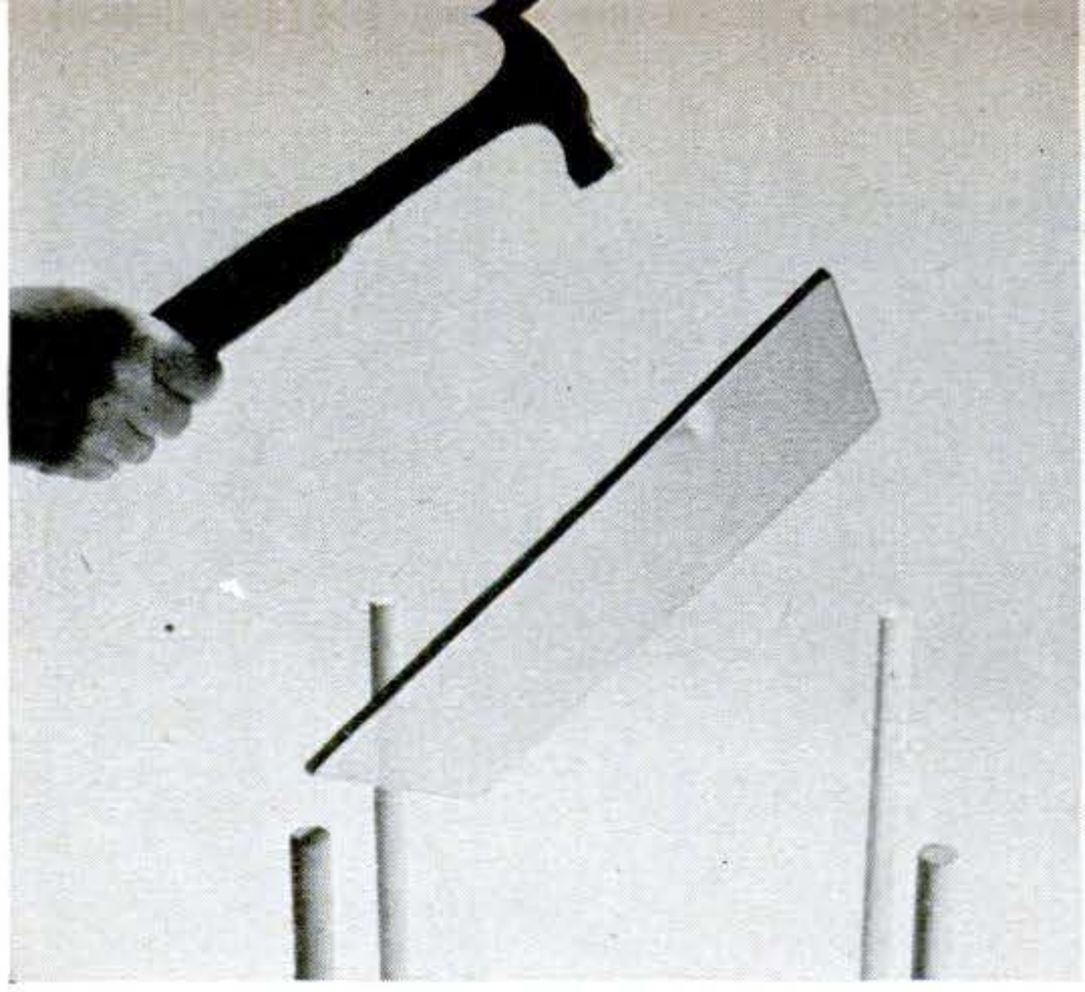

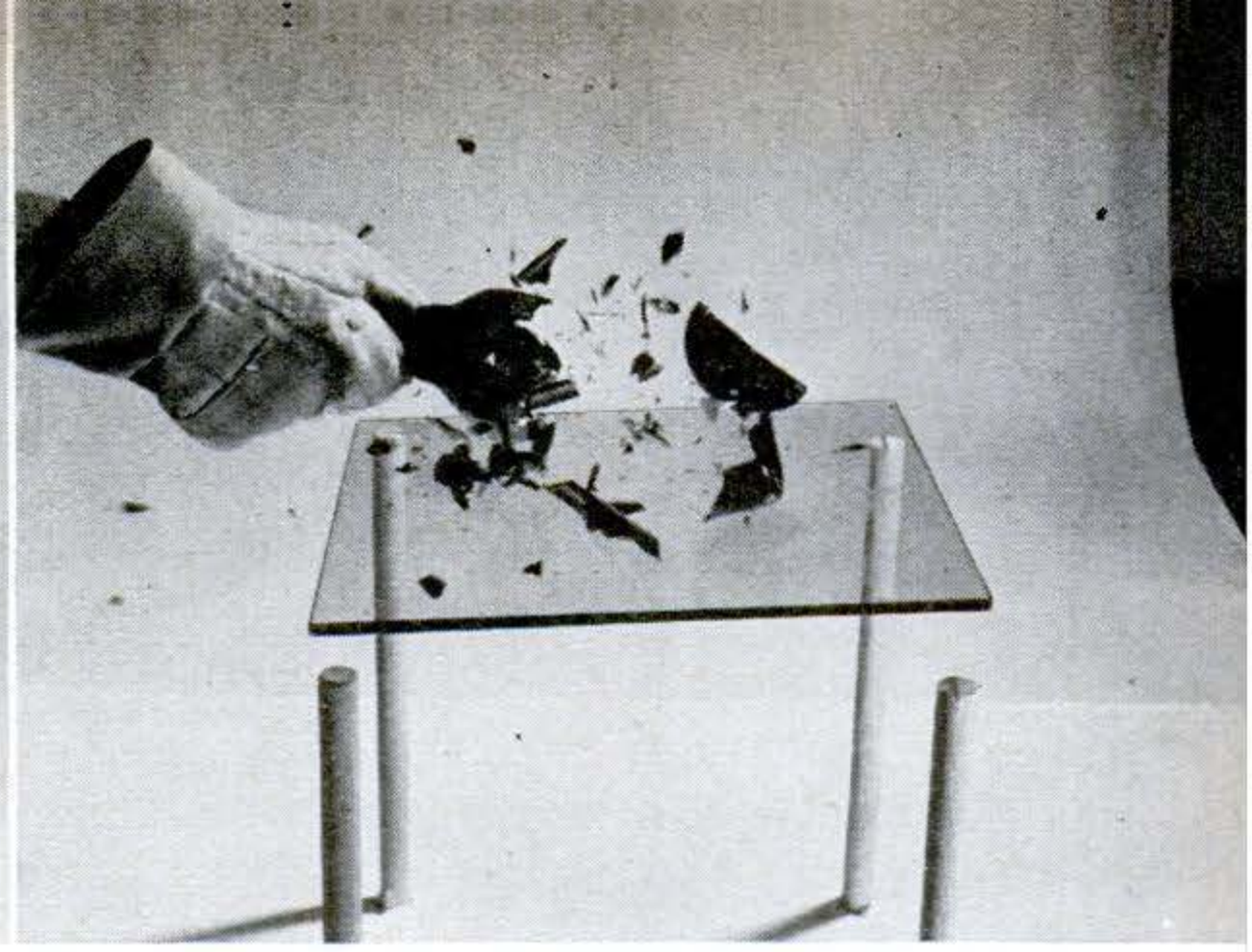

Under hard hammer blow, tempered glass bounces. Blow from a bottle shatters bottle alone.

had seen published photographs of dramatically crazed auto glass.

The groundwork: When in April PSM's editor told me to investigate the windshield pox, I had no head start. I was aware, though, that Buick had been bucking a widespread and unfounded windshield-breakage rumor ever since the new models were announced last January. And that in February a weekly magazine had printed a tale of a "mystery mile" of English highway where windshields were supposed to be shattering inexplicably. That the government had announced three big thermonuclear shots in the Pacific on March 1 and 26 and on April 6. And finally, that on April 8 a weekly magazine with a circulation of 5,400,000 had run an excited account of 1,500 windshields pocked in a single week in Bellingham, Wash.

The Seattle story. PSM's western editor, Andrew Boone, hurried to Seattle, where pitting reports were heavy. In a few days his notes arrived.

"First reports in Bellingham mid-March, spreading in following weeks. By night of April 14, reports started hitting Seattle police board. Next seven-day period 4,294 windshields reported damaged in Seattle. Virtually none since.

"No pellets or hard substances found. Seattle police exclude vandalism. But officers meeting in Everett feel certain there is some vandalism. In Arlington, small pieces of white rock, of type used for roofing, found on hoods of some cars.

"Seattle police received 500 calls on April 15. They called Portland police requesting spot-check there. Back report: 8-9 per cent Portland windshields showed ordinary road damage.

"Notes from talk with Harley Bovee, U. of Washington expert investigating

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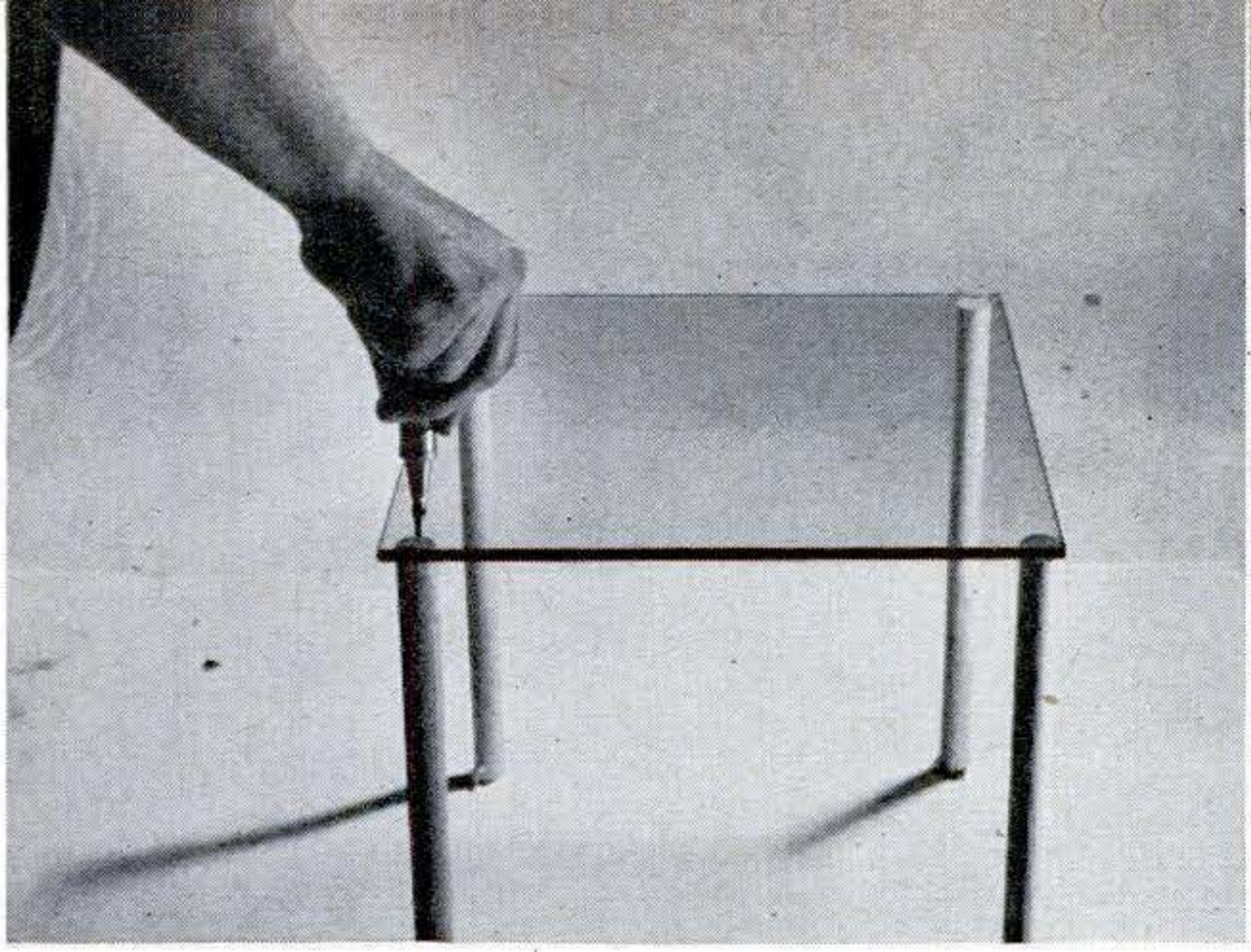
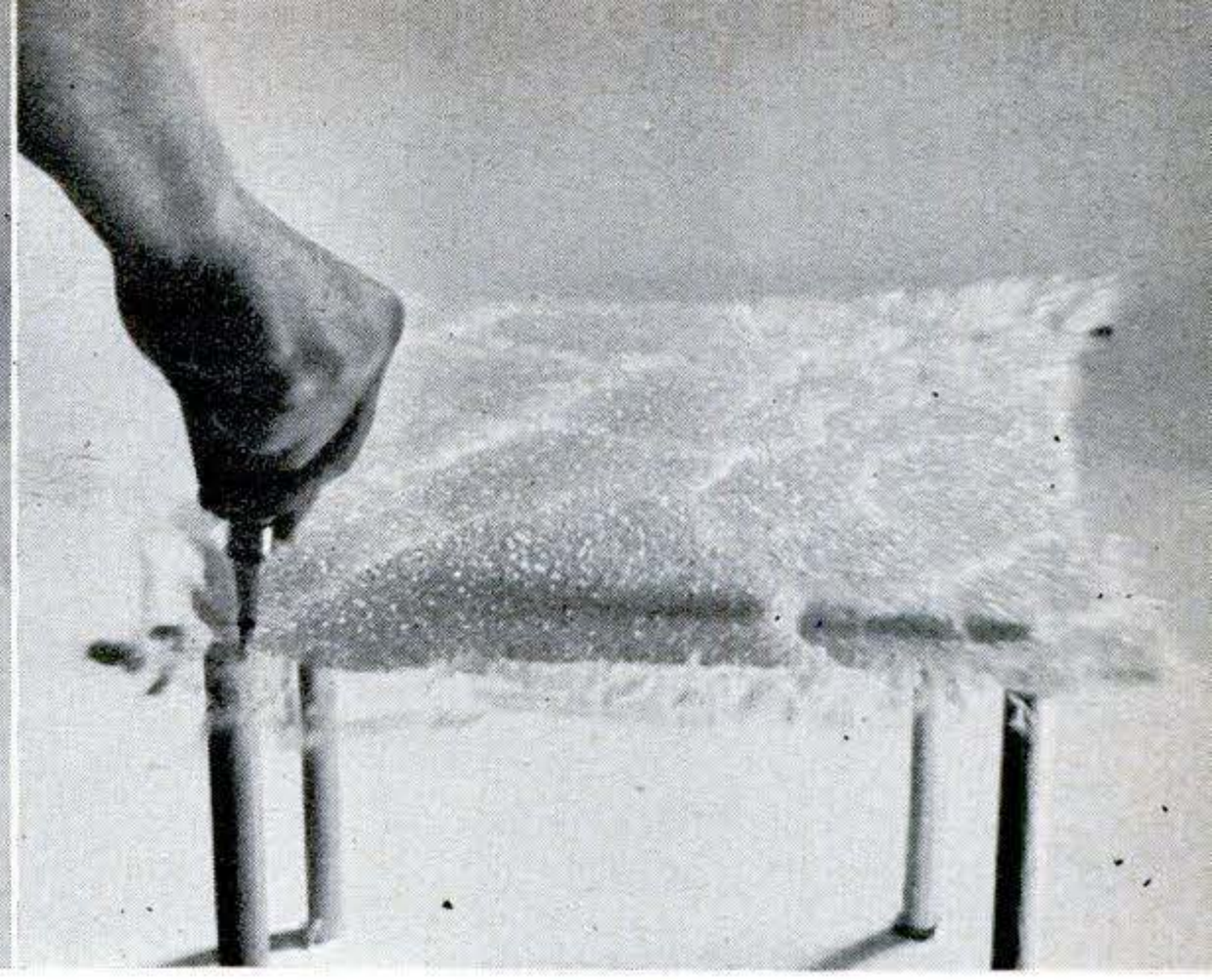
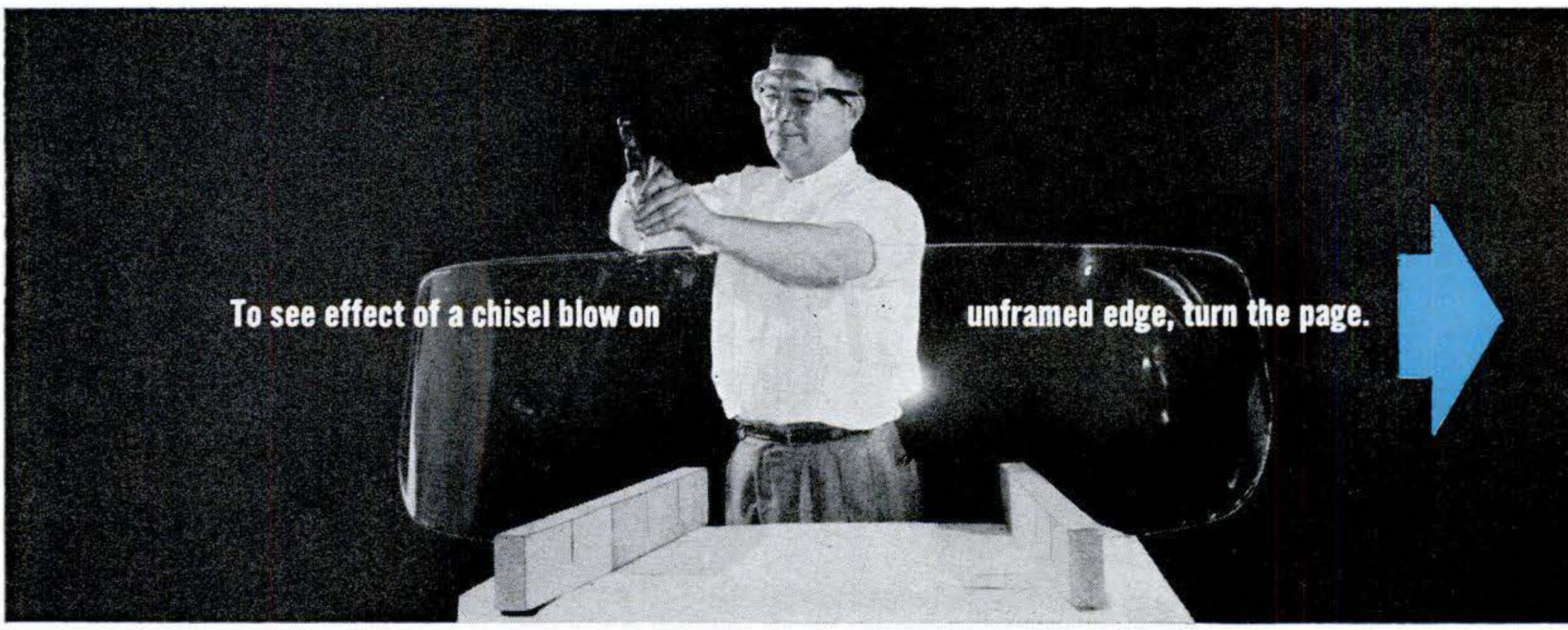




But machinist's punch, above solid backing, produces this dramatic result. Note honeycomb.



windshields: Air-particle samples collected on greased plates, and test windshields exposed on building roof, showed nothing. Screened police reports indicate three kinds of damage: (1) flared cone ¼ to ½ in. in diameter, occurring in one of every 10 reports; (2) pits about ⅛-in. wide and deep; and (3) tiny chips, about 1/16-in. across, the commonest kind.

"Bovee getting some unusual reports on which he withholds comment: glass breaking on store counter while customer reported simultaneous itching; man on nearby island who reported seeing small glow near Big Dipper; and man who reported seeing small spheres emerging from auto tailpipes."

"Disintegrating" glass. While Boone was checking Seattle, I hit the road, too. First stop was Washington, D.C., at the National Bureau of Standards. The chief of the Bureau's glass section is C. H. Hahner, a courteous, scholarly scientist who is widely respected among glass experts. "I can't help on some of those wilder stories," he told me, "but maybe I can narrow it down. Many newspaper pictures I've seen show something that's no 'mystery' at all. They simply show something the public hasn't heard of."

Ever since the late Thirties, Hahner explained, the rear windows of closed U.S. cars have been made of tempered, rather than laminated, glass. This is a special high-strength glass—commonly seen on modern store and office doors—that is about four times stronger than ordinary plate. It is made by suddenly air-cooling the surfaces, which sets up "frozen" stresses within it.

If tempered glass does fracture, Hahner told me, the entire pane or light crazes over all at once. The moment its balanced stresses are upset, the glass

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Blooey! In car rear window, with "surround" holding glass, it would craze but not fly apart.

seems to crumble over its whole area in a characteristic honeycomb pattern. In auto rear windows, this actually amounts to a safety factor, since the honeycombed remains will give only superficial cuts, unlike the lethal knives of ordinary shattered glass.

"Tempered auto glass breaks so rarely," he explained, "that very few motorists have ever seen what it looks like. So when newspapers run pictures of the dramatic result, it isn't surprising that talk about 'mysteriously decomposed or disintegrating auto glass' gets about. The important thing to understand is that this doesn't happen to windshields or side windows, but to rear windows."

"What can make it let go?"

"Tempered glass fractures under severe impact or distortion. One theory is that it sometimes happens as a result of sudden temperature change. This may not affect the glass directly, but may cause expansion or contraction of the steel car body. If the glass isn't properly installed, this might put twisting or racking force on the glass. You understand that this doesn't happen very often. It needn't; if it happens only now and then, and if pictures of it are published, it will naturally seem strange to people."

"What about the pitted windshields?"

"I don't have any first-hand information. But I can say that I haven't heard of anything beyond what might be caused by routine local conditions—stone damage, youngsters with slingshots, and the like. Better talk to the people at Libbey-Owens-Ford and Pittsburgh Plate—they're the really big outfits in auto glass."

The Toledo story. A couple of plane hours out of Washington brought me to the Toledo empire of Libbey-Owens-Ford—and quite an empire it is, since the company has long been General Motors' prime supplier of auto glass, among other

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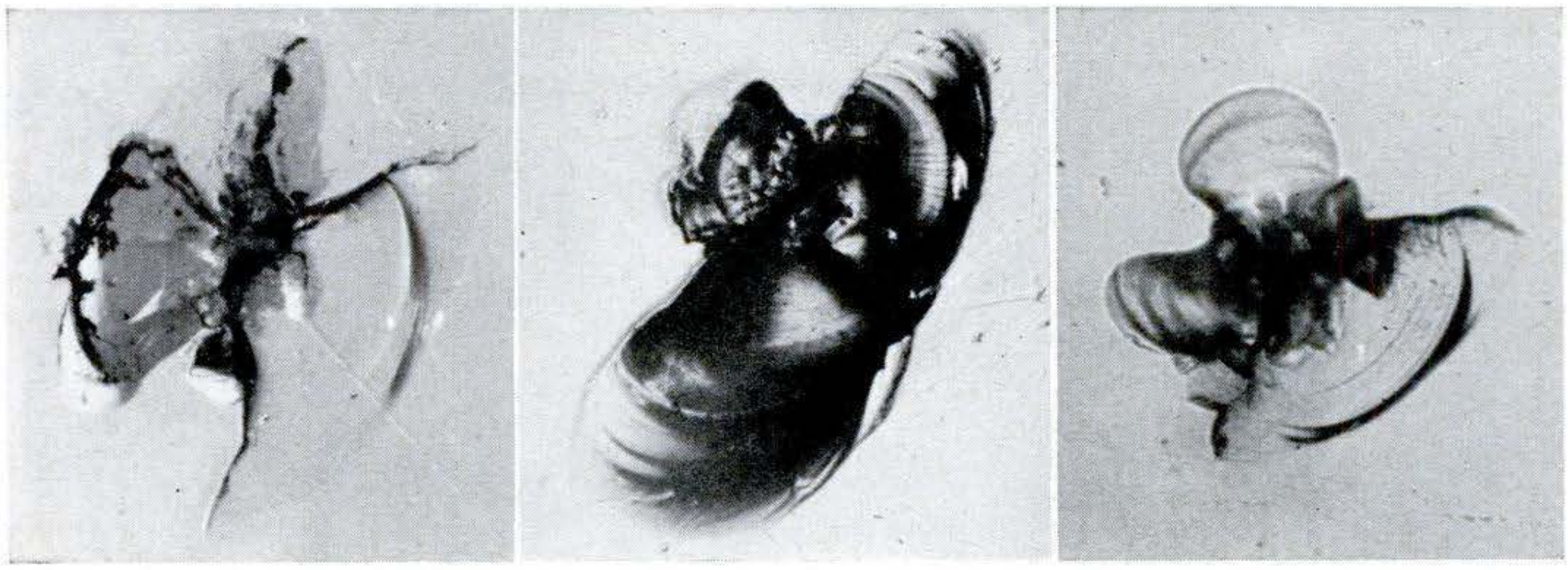
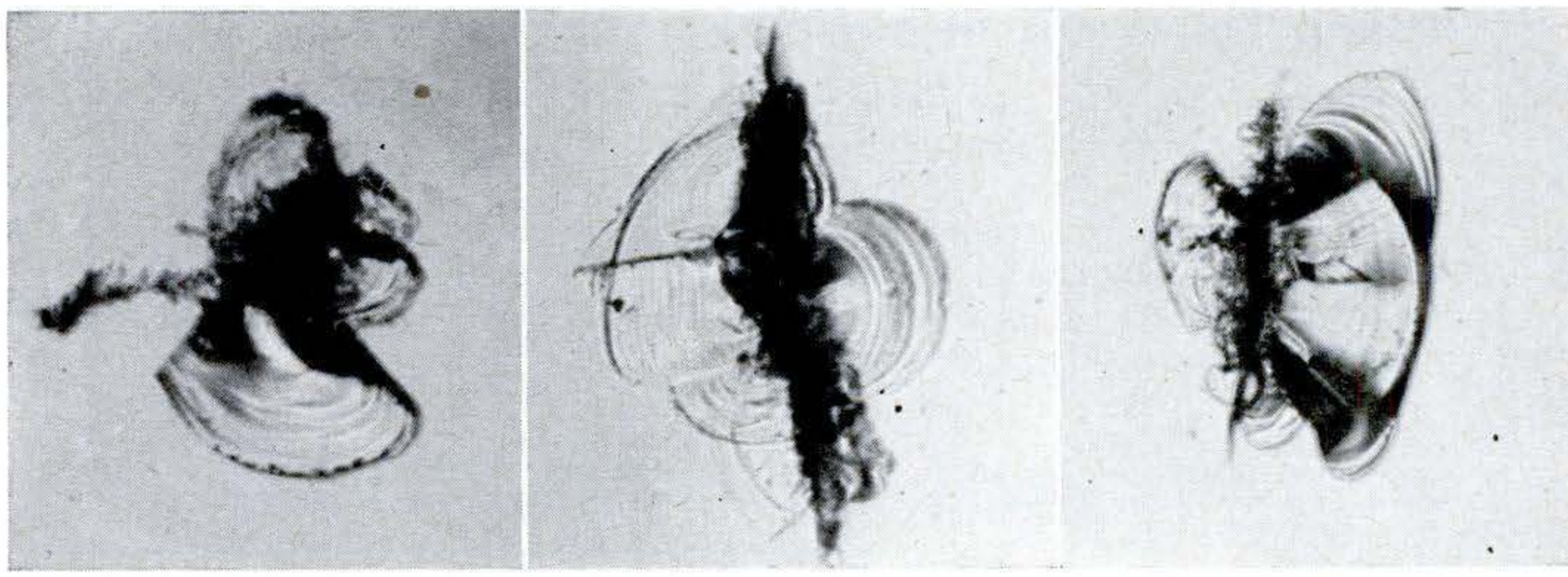
Guess which of these enlarged pockmarks are lab made



These typical pocks, enlarged about 40 times, were found on windshields in Seattle area.



Similarly enlarged pocks were made by Pittsburgh Plate by hurling tiny stones at glass.

things. I was shown through a remarkable number of glass doors to the offices of L-O-F spokesman James Ashley.

"I hope you're not going to ask about pitted windshields," he said wearily.

I learned that L-O-F laboratory scientists and field men had found absolutely nothing in the pitted windshields shipped in from pox areas. Nothing, Ashley told me, beyond marks of the sort typically produced by gravel impact or the like.

In some communities where the pox had hit hard, such as Canton, Ohio, investigation indicated that vandalism was a major factor—this being the term for what happens when the juices of spring flow through adolescents armed with air rifles. In many cities published stories of "disintegrating" windshields were accompanied by photographs of honeycombed rear windows.

Radioactivity, the dominant haunt of the decade, turned up in many rumors. But L-O-F technicians couldn't find the slightest evidence that the pits were "hot," and they took comfort in a spiking denial by AEC experts at the Argonne National Laboratory. Another epidemic tale, that pitting was caused by defective glass, just didn't make scientific sense: there had been no change in materials or manufacture, and field reports showed no suspicious concentration according to make of car or year of manufacture.

"The hard fact," Ashley concluded, "is that this seems to be wholly psychological. Certainly there are some marks being found on windshields. But there always have been. If after hearing rumors you hurry out to examine your own windshield closely, you stand a fair chance of being able to find some 'pits'."

The Pittsburgh story. At Pittsburgh Plate Glass, supplier to Dodge, Plymouth, De Soto, Chrysler, Ford and some

[*Continued on page 218*]

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Plane Takes Off in 100 Feet

THE new, five-place Skylark, as versatile as its namesake, takes off and lands within 100 feet, flies as slow as 25 m.p.h. or as fast as 165. Its shrouds, a full-span extension of the leading edge of the wing, and outsize flaps make it extra-stable. The Robertson Development Corp., St. Charles, Mo., produced it.

Streamlined Motorbike, Stout Nerves, Win Tough British Race

THE daring sidecar rider in this new English motorcycle almost had his ear to the ground on curves, but it was worth it. The vehicle, a Norton Watsonian, won the Racing Club's 1954 sidecar championship race. Another streamlined combo that made its debut recently had its engine mounted behind the driver's bucket seat.

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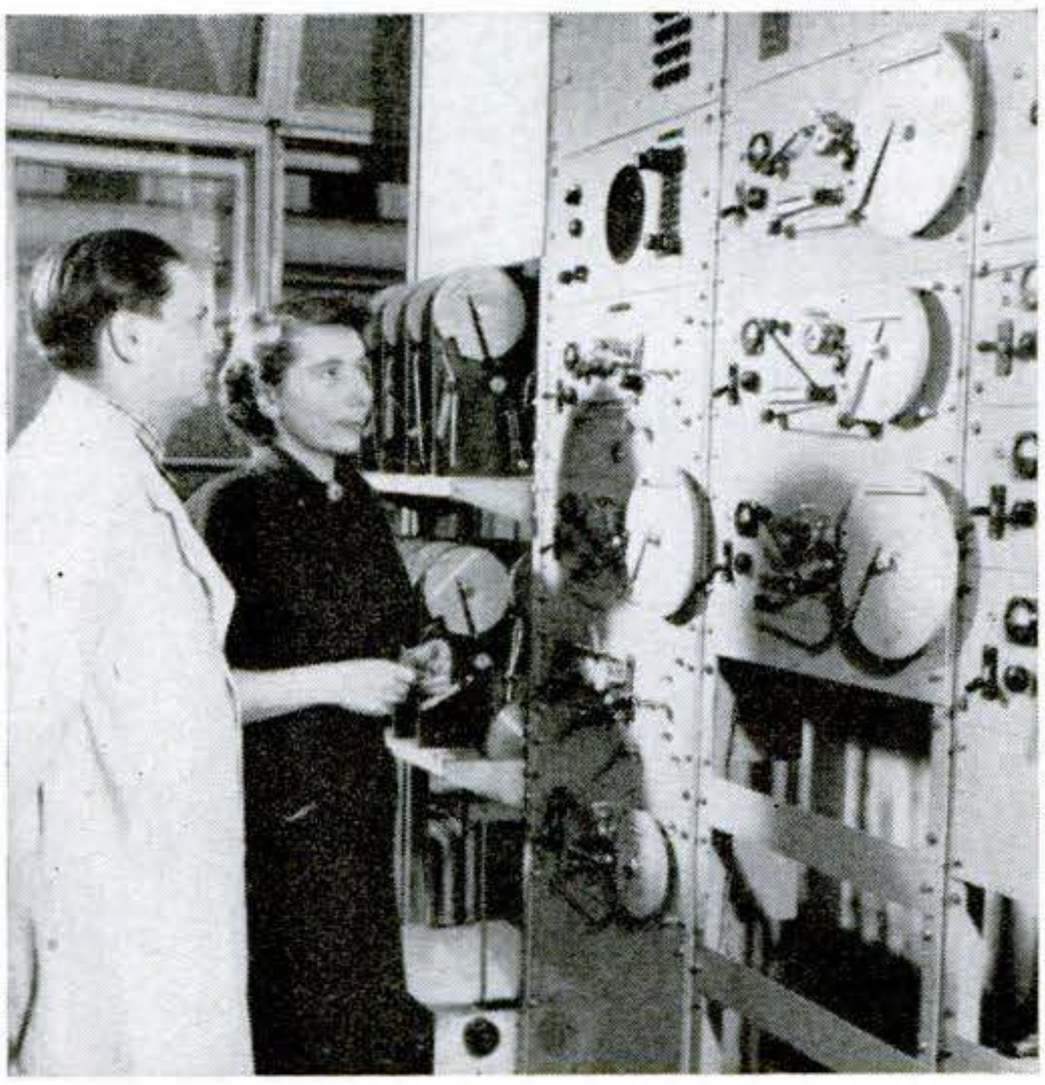
Vienna's Youngsters Phone for Stories



FAIRY tales, recipes, riddles, stock-market quotations, weather and road reports are all available at the spin of a dial to Viennese with telephones. All they need to know is the number they want. There are 15 such services altogether. Children (right, above) quickly caught on to the correct number for stories, which change daily.

Grete Zillner (left, above) records most of the talking on tapes, located on a single board in the telephone exchange.

Camera-Toting Copter Tags Sports Cars on Stiff Movie Run

SUPPOSEDLY racing from Canada to Mexico, the sports cars above never got far from Reno, Nev., though some hit 100 miles an hour. Driven by professionals, including Howard Darrin and Chuck Tatum, who also built them, the cars were making scenes, mostly filmed from a helicopter, for a new movie called "Johnny Dark."

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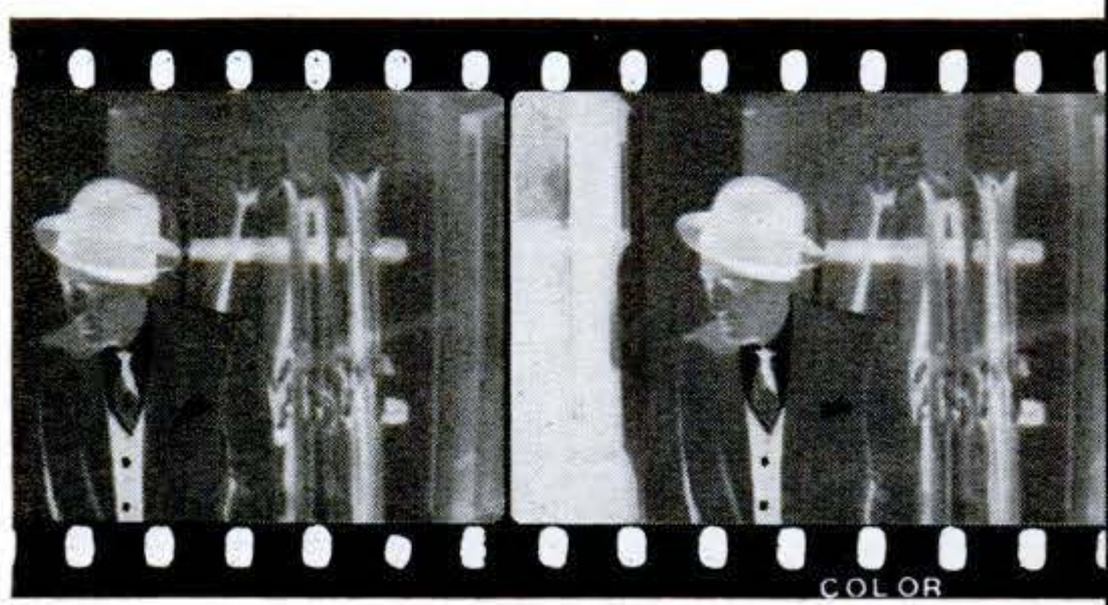
Hollywood Now Shoots

Turning film in the camera turns the trick that gives VistaVision extra-large negatives for clearer and brighter big-screen projection.



BING CROSBY sat hunched in an easy chair intently watching a gigantic image of himself dancing across the world's largest indoor screen. Stretching across one end of a Hollywood sound stage, the screen was big enough to display 13,000 19-inch TV images.

What Bing witnessed were scenes—rushes—from the previous day's shooting of Irving Berlin's "White Christmas," first picture made by a new big-screen process called VistaVision.

FILM runs past VistaVision camera lens sideways. Thus, frames are as high as standard ones are wide—that is, negative area is much larger. Reduced to normal size, film can be projected on big screen without graininess.

What does this process mean to movie fans with Bing blown up a couple of dozen times life size?

"Whee!" exclaimed a blond steno who had wandered in. "His eyes are blue!"

Yes, you can see the color of the groaner's orbs now. But the new process promises to accomplish far more.

VistaVision can be played on any movie screen in the world. It requires no trick lenses or expensive sound systems in the theater. A projectionist simply threads a standard 35-mm. print into the machine, snaps on the light—and the show's on, in any size and practically any dimension he desires.

Larger Image on Same Negative

Here's how the picture is made, as illustrated by "White Christmas," which you'll be able to see late this year. You build a set slightly wider than usual. You light it as usual. You focus your camera on the scene and start cranking. Only the camera is radically different. The film runs sideways instead of down. And, although the same 35-mm. stock is used, the image on the negative is 2½ times bigger.

You cannot run this film through a projector and get a satisfactory picture,

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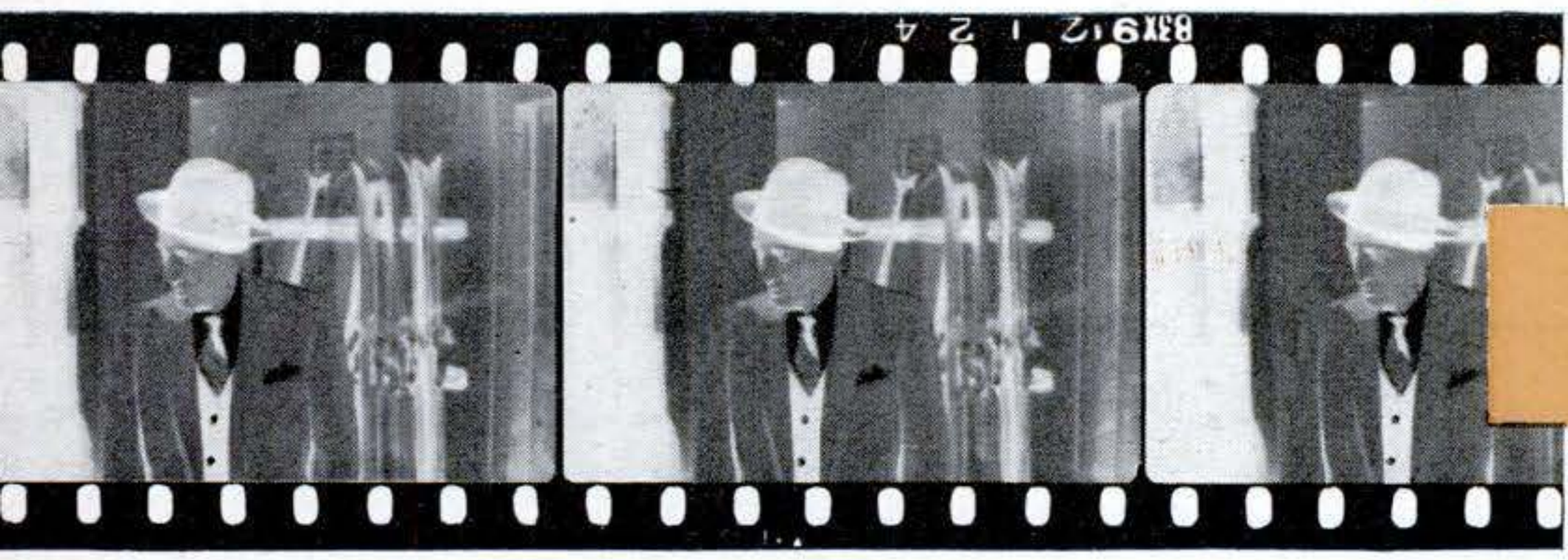
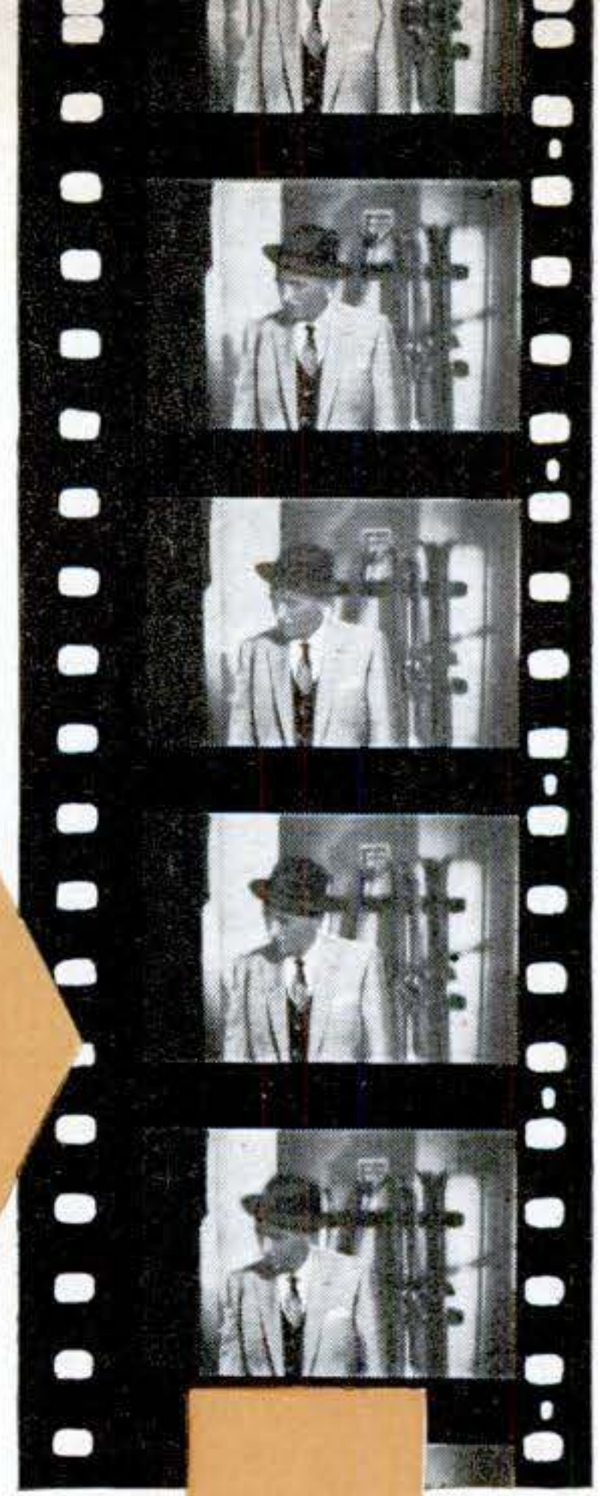
Movies Sideways





BIG NEGATIVES are the secret of VistaVision. Frames are then reduced to 35-mm. size and turned 90 degrees (strip at right). This film can be projected on screens in various sizes and proportions—width to height—as in close-up below.

because all the characters would seem to be walking on the wall. So you rotate the film 90 degrees, while at the same time reducing the image to a standard 35-mm. negative, and everybody comes out right side up. That, in a nutshell, is the principle of VistaVision.

Until two years ago, small negatives provided good prints for projection onto small screens. Then Cinerama touched off a wave of big screens. More than 4,000 have gone up, and more are being installed every day.

Often the big picture is simply blown up from a standard 35-mm. negative and contact print. The pictures look some-

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what better, but, says John R. Bishop, head of Paramount's camera department, "the negative is the bad boy. We simply can't store enough detail in its small size. Sit close to the screen, and your eyes tire. Too fuzzy, too grainy."

Detail for the Widest Screen

As big screens blossomed, Bishop began searching for a way to produce an image large enough to fill, with sharp detail, the widest screen that might be built. A larger negative was needed. But how could it be handled in the camera?

Bishop first got the idea of VistaVision from the Leica still camera. Although the Leica also uses 35-mm. film, its lens exposes an area double that of the image on the movie film. Turn the Leica sideways, and the picture has about the same proportions as a big theater screen.

Fine so far. He then began searching for a movement that would transport the eight perforations in a double frame past the lens. He remembered an old color system built in 1926 by William P. Stein that exposed two 35-mm. color negatives to form a single projection picture. Bishop obtained one of these movements, installed a Leica lens in a Mitchell camera, turned the camera on its side, and shot a test. It worked.

Luckily for the producers, no radical changes are required in set building. Artists compose and balance a set in a ratio of 1.66 to one—two-thirds wider than high. This brings it closer to the proportions the eye naturally takes in.

Because VistaVision is primarily a process of shooting on a large area and reducing to a smaller area, the chemistry of fine-grain printing, eliminating fuzziness, permits screens to go up and up in size.

Unlike Twentieth Century-Fox, which spent large sums on CinemaScope before the cameras began rolling on "The Robe," Paramount laid out only trivial amounts reworking camera mechanisms. Convinced that what's good for the industry is good as well for Paramount, they've made camera plans and techniques available to all without cost.

The other afternoon I saw the first results of VistaVision. Bing and Danny Kaye cavorted in a colorful dance number. The first picture was what Loran Ryder, the studio's sound chief, calls "postage-stamp" size. That's a nine-by-12-foot picture that lots of movie houses display even today. A change in lenses, and up came a dance sequence 23 feet wide, another 30 feet wide, then another 61 feet across. This was the largest square footage ever shown. Yet as the picture continued to grow sideways, I noted that it continued to grow in height, and stayed clean and sharp.

As the shots of Bing Crosby and Danny Kaye expanded, the dancers also grew in size. But, and this is important, more foreground and background came into view at the top and bottom of the screen. The human figures did not "grow" as rapidly as the over-all scenes.

As for the actors' reaction to VistaVision, "I do what I always do," Bing told me, "and the cameraman tells me whether I'm in the picture or out."

It's just about that simple.—*Andrew R. Boone.*

WHEELING his truck-trailer rig on a new route, Joe hit a winding, narrow detour. Just past a sharp reverse curve, a low railroad underpass made him brake to a stop. To his dismay the posted clearance was three inches less than the total height of his rig. To turn around was impossible, to back along the winding road unthinkably dangerous.

A boy on a bike came up and helped Joe ponder his dilemma. Shortly the boy gave Joe an idea. Ten minutes later the rig was rolling again.

...How Come?

ANSWER: *Knowing the ways of tires from his own bike, the boy told Joe to let enough air out of the huge truck and trailer tires to lower the whole rig by three inches.*

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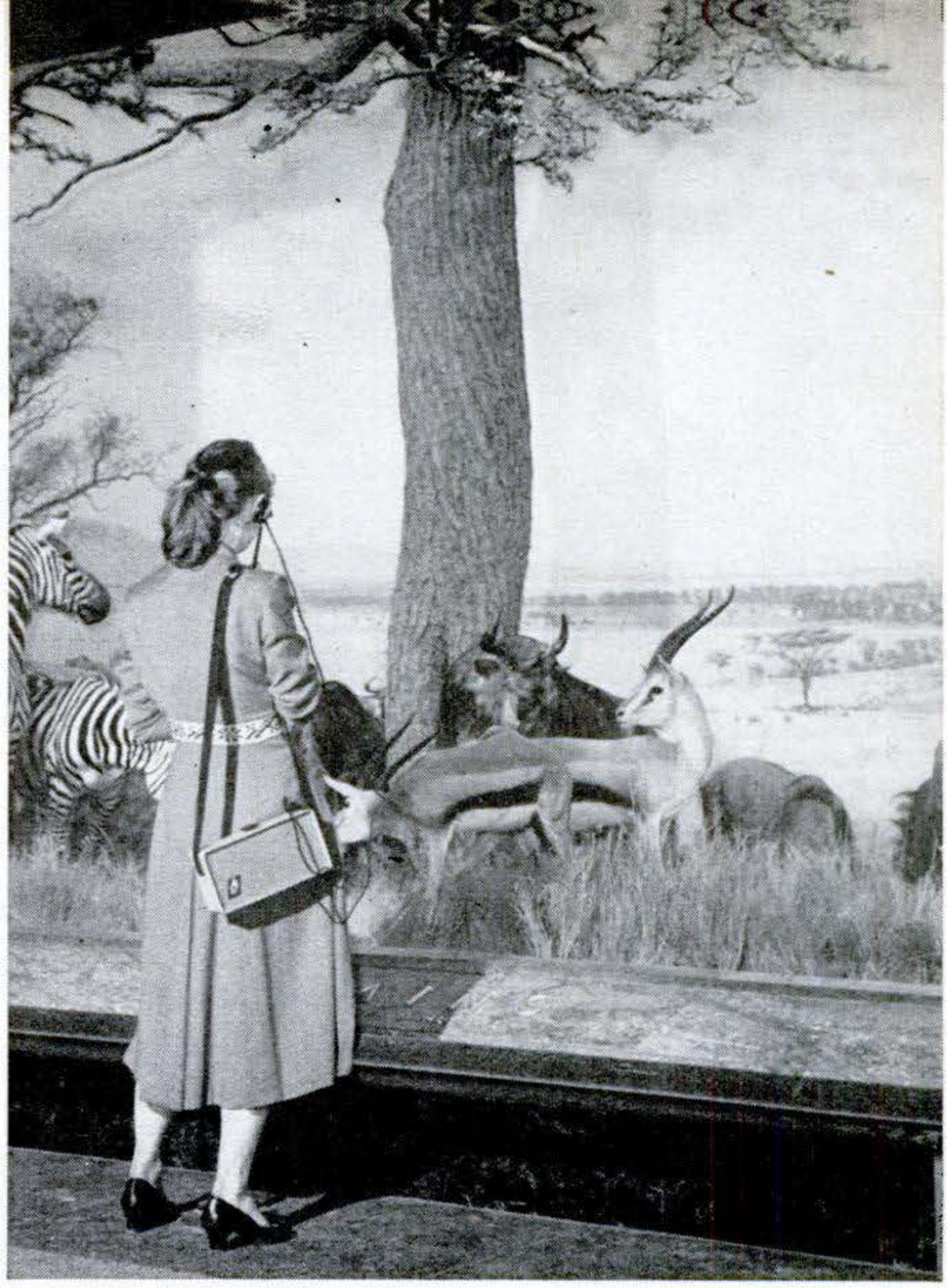
Individual Radio Sets Tell Museum Visitors What They Are Seeing



A VISITOR to the American Museum of Natural History, New York City, may now be wired for sound as he enters the building. He may, that is, rent a small, earphone-equipped radio receiver on which to pick up continuous explanatory broadcasts as he strolls through parts of the museum and sees the exhibits (right, above). The receiver, on a shoulder strap, weighs only a pound. It has only one knob and that controls volume. The earphone for men is on a headset like a telephone operator's. The earphone for women is on a stick that is held in one hand.

Behind the scenes, five record players (left, above) send out talks to five museum halls equipped with loop antennas. They broadcast brief descriptions of exhibits.

The American Museum is said to be the first institution to use radio guides.

Motorized Blinker Protects Repairmen

WHEN the Broadway Maintenance Corp., which takes care of 250,000 New York City street lights, sends out a service truck at night, it sends along another truck to park behind and protect it. On the second truck's cab is a two-by-six-foot electric sign that blinks a big "SLOW" at oncoming cars.

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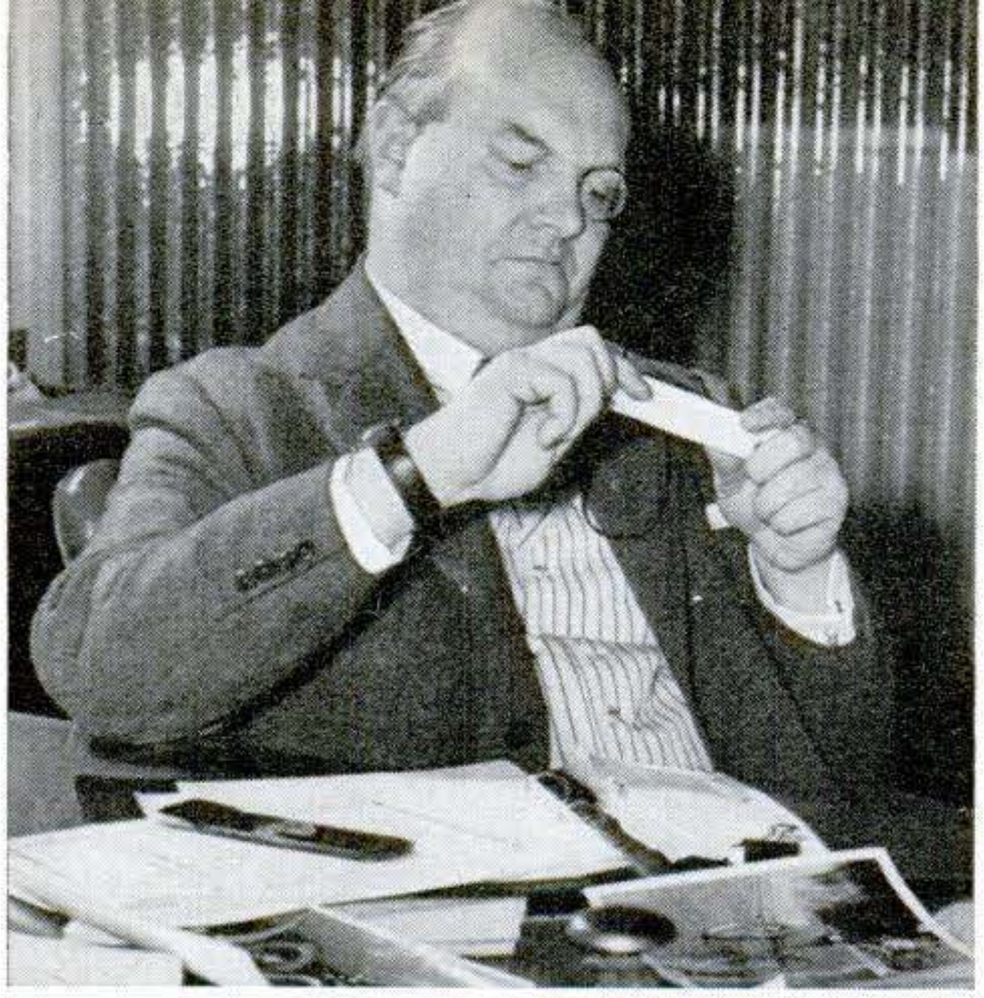
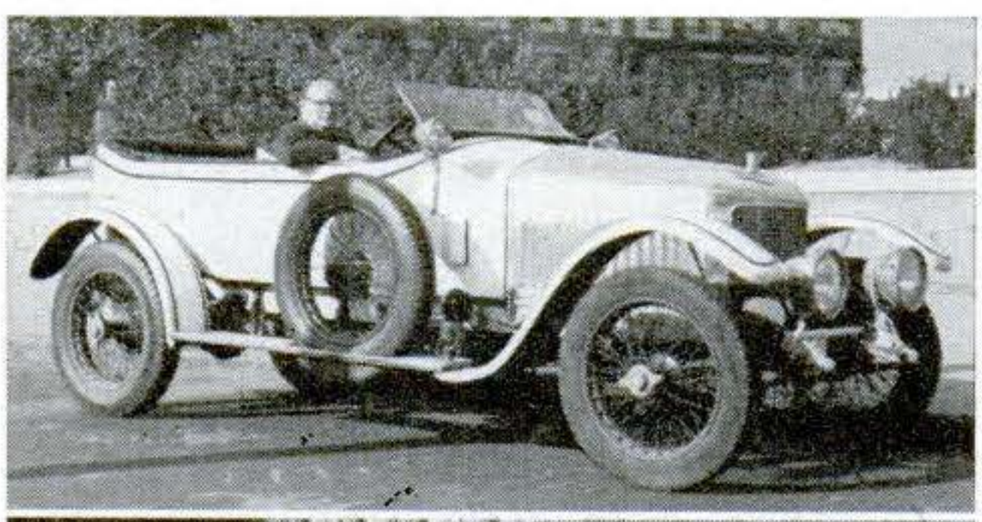


The writer of this article, Laurence Pomeroy, is widely respected abroad as the foremost British "car critic." The author of several definitive books on high-performance engines, he is Technical Editor of the British weekly, *The Motor*. Not just a desk expert, he has driven almost everything on wheels, and has designed and manufactured a number of special superchargers. When he visited Detroit and New York this year, PSM invited Mr. Pomeroy to give his impressions of U.S. automobiles. Reading his pungent criticisms, Americans may gain new insight into the somewhat eccentric deportment of foreign vehicles on our own highways.



At the wheel of a 1914 Vauxhall (upper photo), Pomeroy practices his preachment that good old cars need never die. Though 38 years old at the time of the picture, the car was still fun to drive, he reports. The little girl is his daughter Pam in a model of the 1913 Vauxhall. Laurence Pomeroy's father was chief engineer for Vauxhall.

A Britisher

This sharp-eyed English expert delivers a pointed report on a tour of the U.S. auto industry.

By Laurence Pomeroy

NO ONE who has spent a day at the General Motors proving ground or technical center, or who has seen the acres of research buildings put up by Ford in recent years, can fail to be impressed by the enormous effort that goes into the products of one of America's biggest industries.

To a European the size of the establishments are staggering. It almost passes belief that Ford employs 6,000 technicians—whereas a twentieth of that number would be on the high side for transatlantic producers.

To carry the paradox further, some of the most famous cars in the world—Rolls Royce, noted for silence and long life; Mercedes Benz, noted for speed and solidity; Alfa Romeo and Ferrari for all-around brilliant performance; and Jaguar, which challenges Cadillac for looks and value—are in many cases produced by design teams that do not add up to even 100 persons. So on the face of it, at least 20 Americans are needed to do the job of one Englishman or Italian!

For Americans—All the "Gimmicks"

The matter is of course by no means as simple as this. For although a fair percentage of American employees are there to support a complex (one may think overelaborate) organization, most are doing a task not attempted overseas.

This is to incorporate in the volume-produced, low-priced car of today all the conveniences and "gimmicks" that were confined to the custom-built car of 1949. By contrast, in Europe 90 percent of the cars are made as simply and cheaply as possible. So, whereas a Chevrolet will

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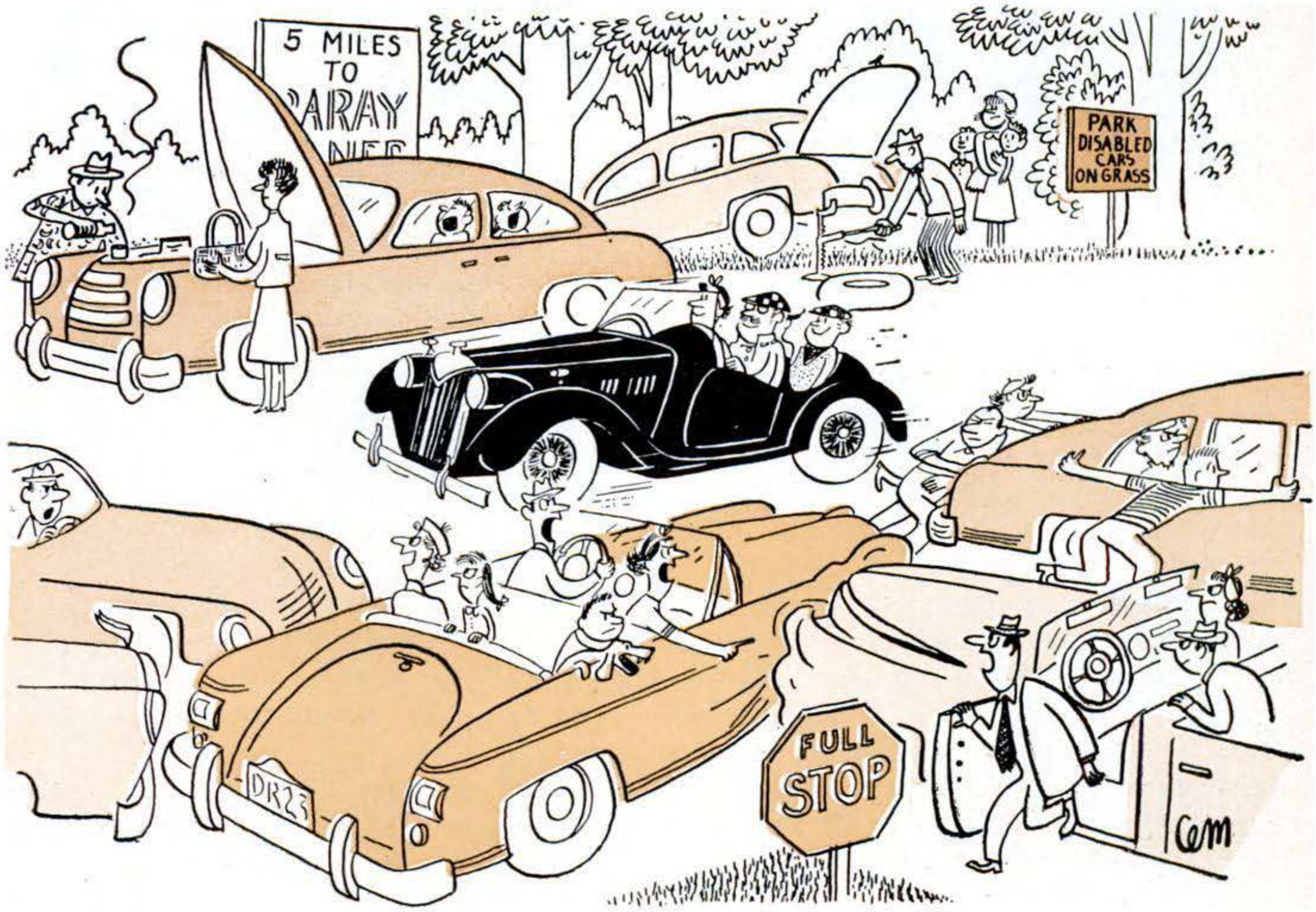
Tees Off on American Cars



"Detroit puts everything into an automobile except economy and fun."

cost a third as much as a Cadillac, the cheapest British car may be bought for a fifteenth of the price of the dearest.

Quite obviously the introduction of automatic transmissions, power steering, power brakes and power seats on really low-priced cars depends on a vast number of engineering man-hours. A dollar saved by shortening a gear shaft will in a year cover the salaries of a hundred quite highly paid designers. It is this that has led to the formation of huge design teams that do not solve problems so much as trample them to death.

But the results are there for all to see. The 1954 American car is a magnificent response to the desires of the 1952 buyer. Still, it utterly neglects two primary requirements of transport as we have known it for some thousands of years. These are economy and fun, and it is remarkable that Detroit puts everything into an automobile except these two things.

The American public showed its contempt for economy transport when it stopped buying the Model T. The vast gains in productivity in the past 25 years find expression in the 100-hp., 3,000-lb., 16-m.p.g. cars making sales in millions a year. A 60-hp., 2,000-lb., 22-m.p.g. car would save the owner as much as $600 in first cost, possibly $100 a year in running costs—or say $250 a year.

And what does the family really get for the extra $250? A squashed six seats in place of a comfortable four. Space and power that will be appreciated on the yearly vacation; but this is only two or three weeks in 52. Social equality with the neighbors; but $250 a year will pay

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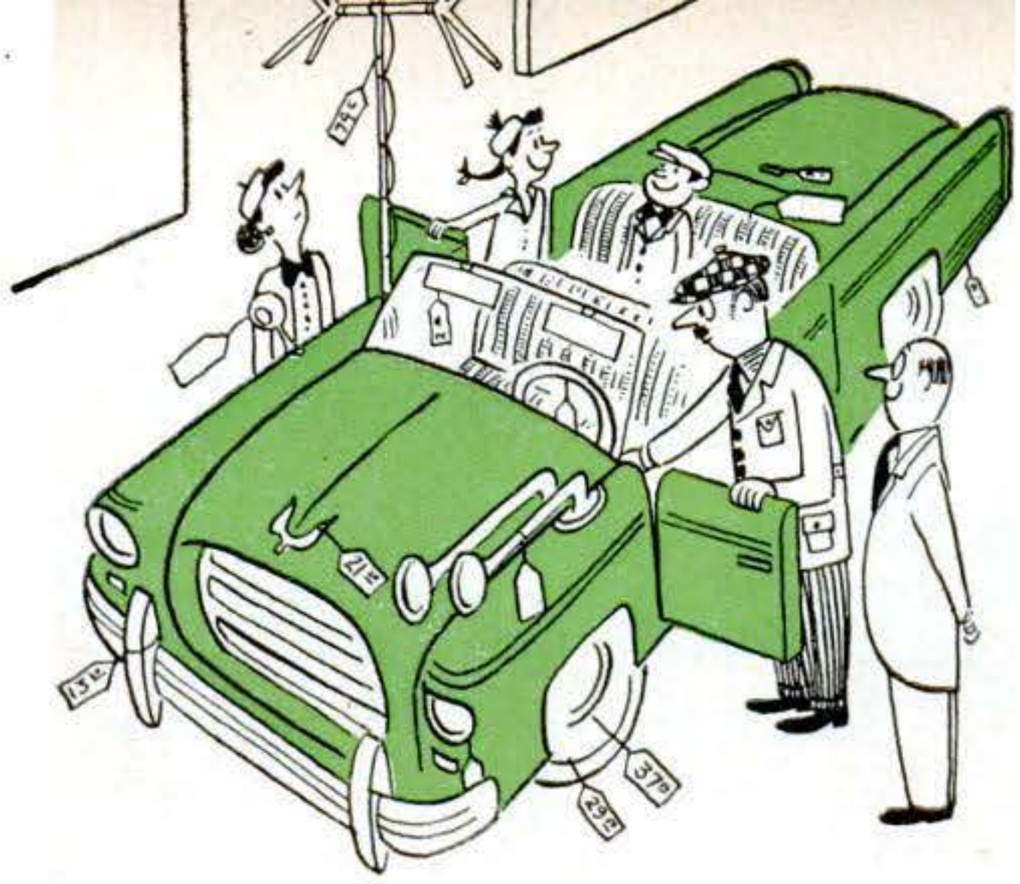
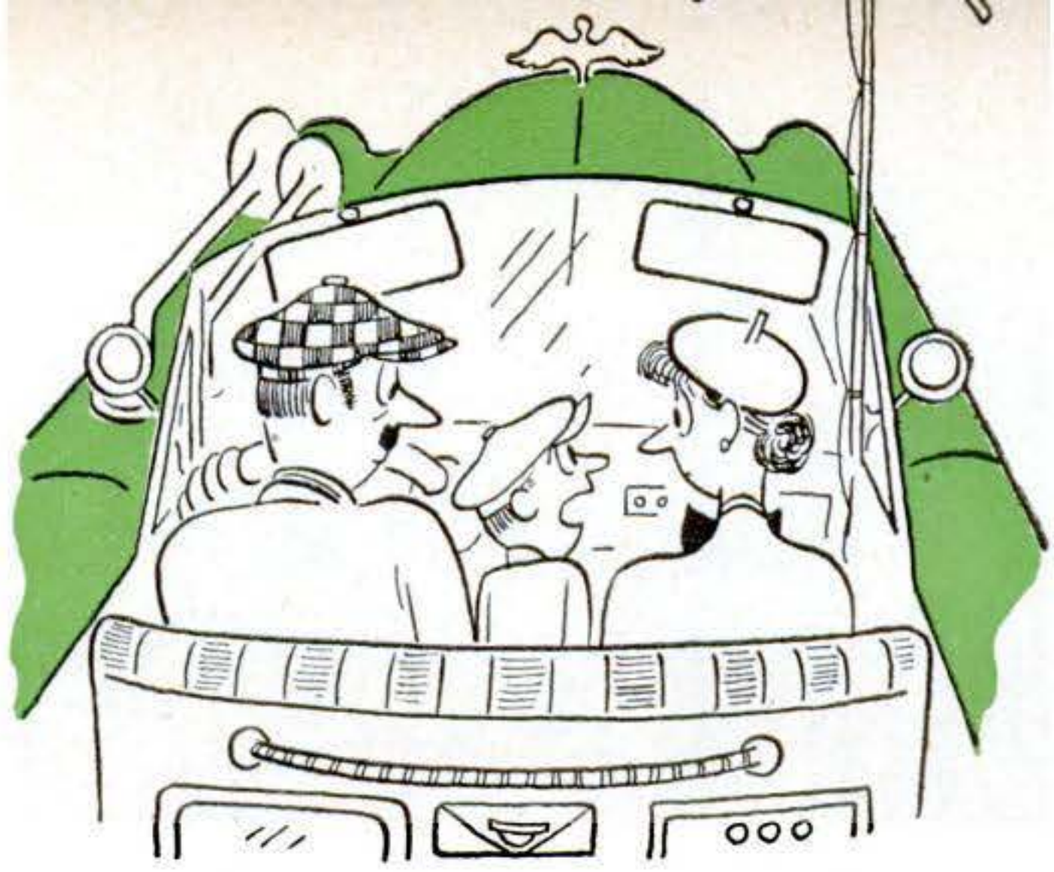


"What does the family really get for $250 more a year?"



". . . a squashed six seats in place of a comfortable four."

for a larger house, new furniture or quite a sizable locker of new clothes. Or in terms of money saved over 25 years, more than $6,000 could be salted away in the bank.

To this the present-day producers have their answer, and it seems a conclusive one. Americans have often had the opportunity of buying small and simple cars, both foreign and domestic, and they have rarely done so in quantities that have prospered the maker or importer. In other words, the all-important buyer, the wife, thinks a big car well worth $20 a month of her spouse's salary.

But does she realize how much her choice contributes to the traffic tangle, to taxes and to the cost of living? Two American cars, with two car lengths between them, occupy 70 feet of road; two European types only 50 feet. And in width, four American cars with a foot on each side take up 35 feet and four small cars only 28 feet. Who pays for this extra roadway?

None other than the motorist!

Disregard of economics is also shown by the preference for low first cost at the expense of long life. Not everyone will enjoy, as I do, setting off for a 100-year-old house in a 40-year-old car wearing a 16-year-old topcoat and a 160-year-old vest. But the war has shown Europeans that car life can be extended over very long periods; indeed, more than half the cars on British roads today are more than 15 years old and still going strong.

But if the American buyer has really decided not to worry about motoring costs, why does he so utterly neglect the possibility of getting real fun, or pleasure, out of the hunk of iron and steel that is probably his second most costly possession?

With **all** past forms of transport—camels, horses, chariots, gigs, sailing vessels and cycles—a few people have found a source of pleasure based on applied skill, courage and judgment. In Europe many still do find this kind of pleasure in competition driving.

More important, and an experience that can be enjoyed any day, is a feeling of harmony between man and mechanism, provided only that the machinery is responsive to the most delicate touch. (We know that automatic gear change and power steering do a fine job; but then so does a hand grenade thrown into a river, if weight of fish caught per day is the only measurement of enjoyment.)

HINT TO AN UNHANDY HANDY MAN

A man can improve most jobs he fills—
By simply applying his hobby skills.

—Hugh Lineback

A Model for Detroit to Emulate

It is not necessary to build costly cars to provide pleasurable motoring. In fact, one of the cheapest British cars is best taken as an example of how steering, cornering, steadiness and stopping can

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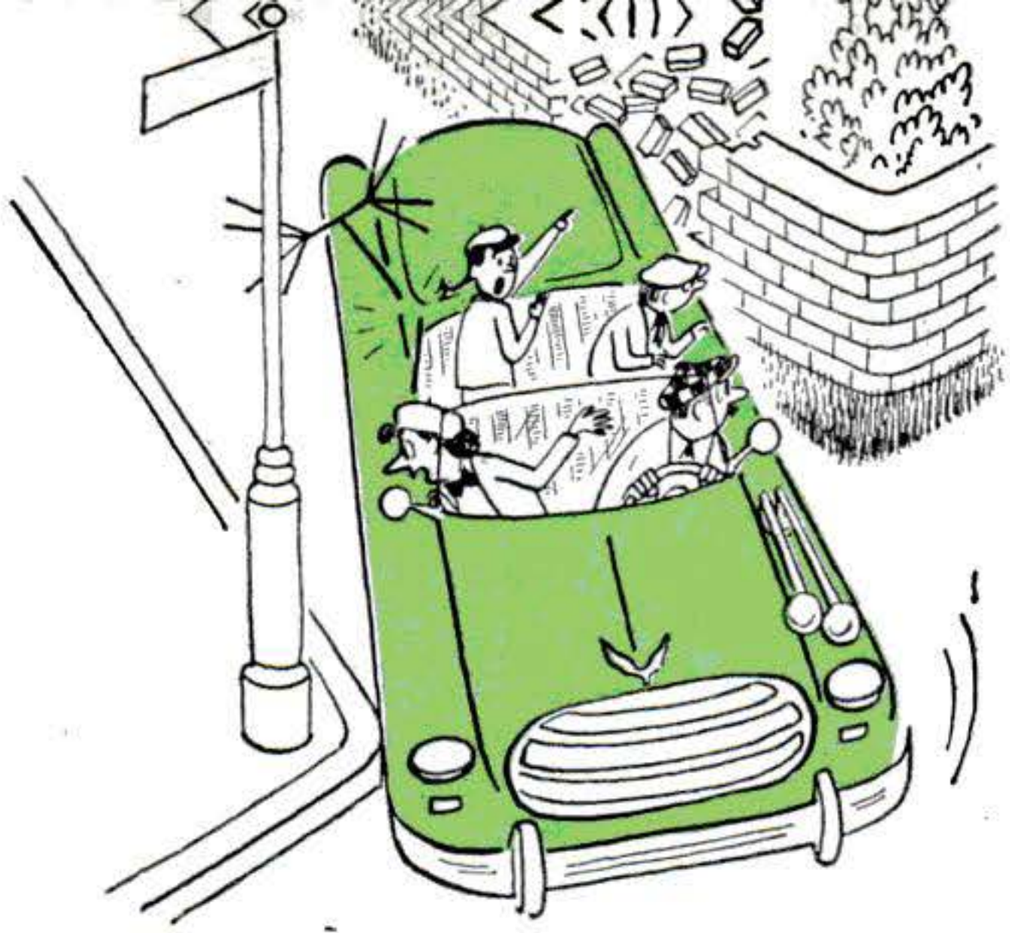
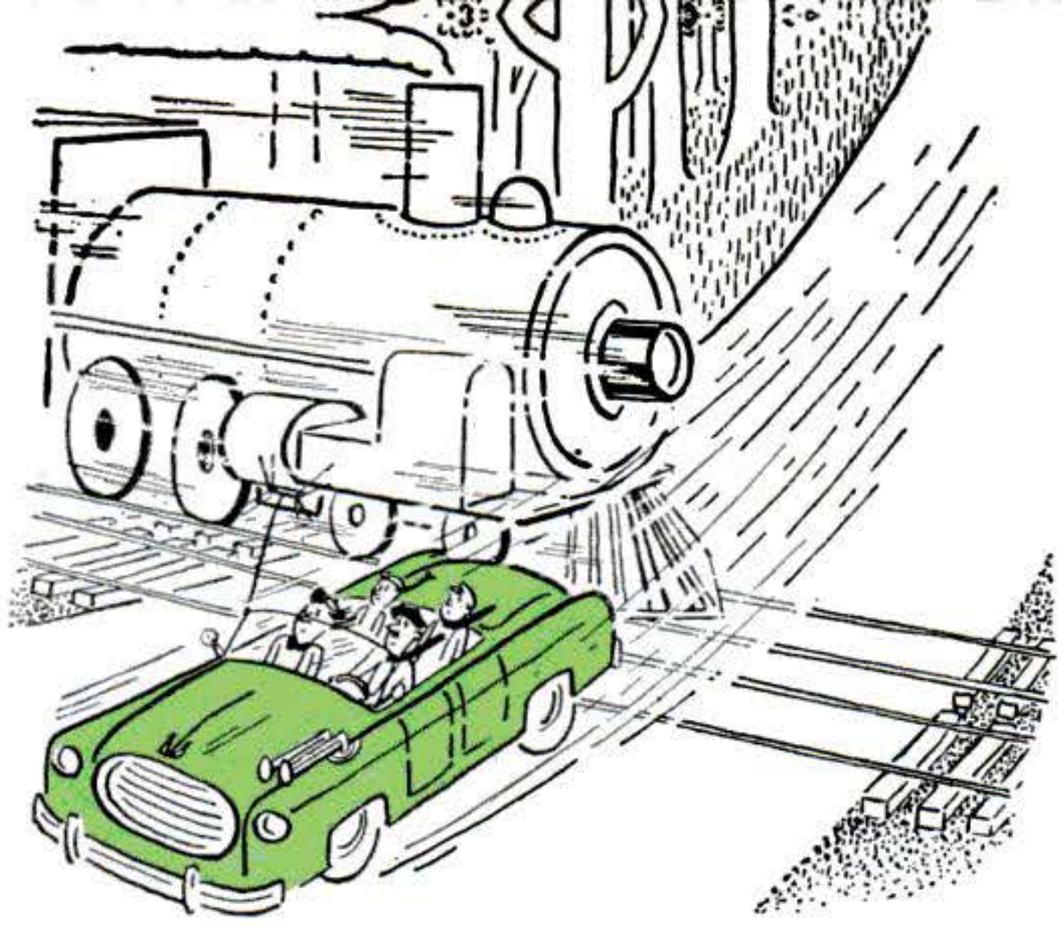


"Designed to operate only in a straight line . . ."



"Brakes may prove unresponsive if used repeatedly."

be brought to a height of excellence that not one Detroit engineer in a thousand has ever experienced!

Here the rapidly growing (if still percentagewise tiny) sports-car club can change the situation. There are today at least 100,000 Americans who know what real motoring can be, whereas 10 years ago there were not a thousand. That Detroit itself detects heightening public interest in motoring for motoring's sake (and one may well be going some place at the same time) is shown by the advent of the Ford Thunderbird and the Chevrolet Corvette.

For City Streets, Non-Stop Driving

It is conceivable that the technical developments built into these special models may affect future designs of American passenger sedans. The current American car appears to have been designed to operate in two conditions only. These are traveling slowly in a straight line in city streets, and traveling at a uniform 55-60 m.p.h. on open highways free from curves or stop signs.

These conditions may fairly represent perhaps 90 percent of the motoring for 90 percent of American drivers. But there are always exceptions, and it seems to me that all too frequently such exceptions may result in serious accidents.

The relaxed driving conferred by the straight-running characteristics of American automobiles is won at the expense of very slow response to the helm in time of emergency. As a result, in the exceptional American conditions that represent normal running in Europe, it is impossible to steer an American car out of an emergency. Low brake-pedal pressures are gained on small brake drums by self-servo shoes coupled with a big mechanical advantage for the driver. Although the brakes may respond well on a first application they prove quite unresponsive if the driver uses them repeatedly, as for driving downhill.

The American car demands a high technical price for acceptability in a mass market dominated by feminine values. In the outer world, with more masculine standards, it may fail to prove acceptable even if currency regulations should make foreign trade easier. END

Want to Sass the Expert?

The foregoing comment on U.S. automobile design will, PSM's editors suspect, stimulate many readers. Some will say, "Hear, hear!" Some will say, "Could be." And no doubt some persons will want to punch Mr. Pomeroy on the snoot. For the five most interesting letters, no more than 150 words long, on this article, received by August 1, PSM will pay $25 apiece. Address The Editor, POPULAR SCIENCE MONTHLY, *353 Fourth Avenue, New York 10, N. Y.*

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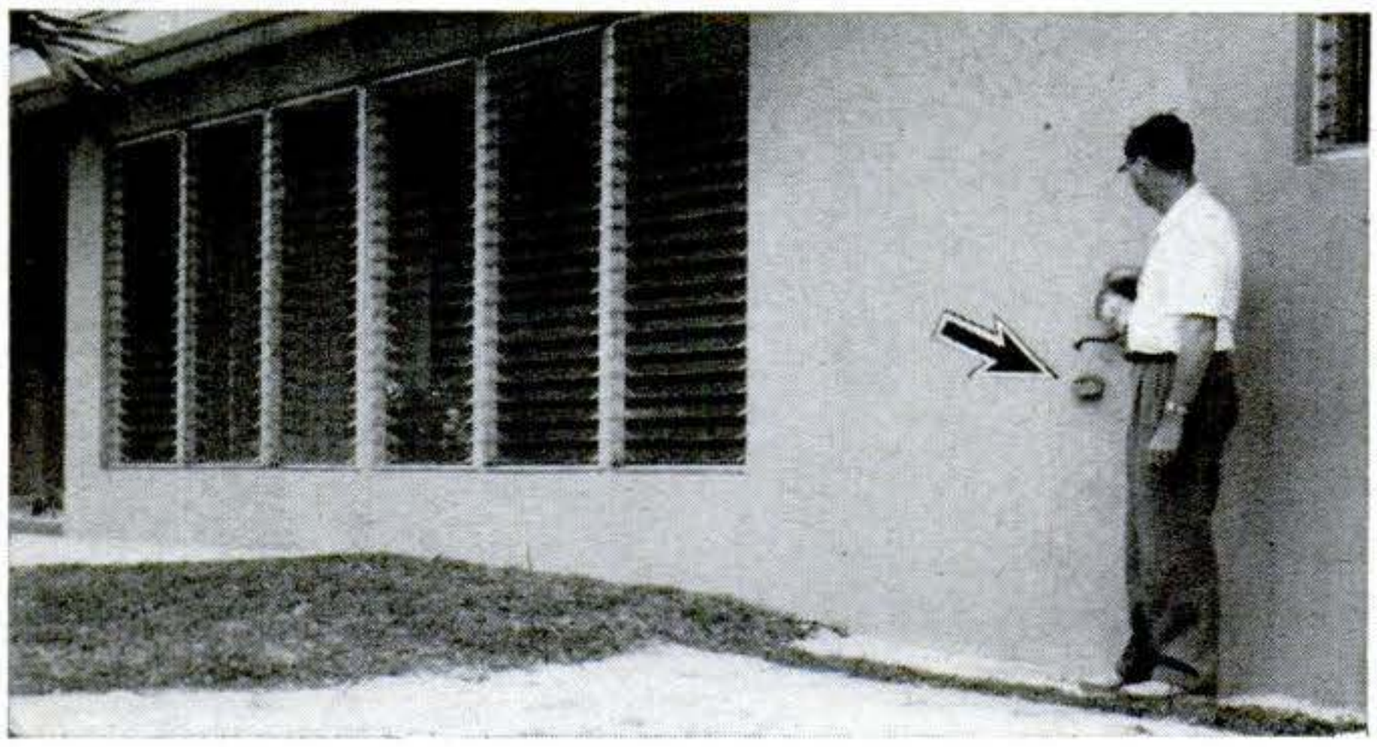
Armored Landing Craft Shields Marines Hitting the Beach

THE Leathernecks are protected on top as well as sides in their new landing craft, the LVTP-5. Fully loaded, the scowlike tractor rides low in the water while personnel peer from six lookout ports set in the deck. The opened lid of one of these ports can be seen at the top of the craft, above the unloading ramp.

Rain Closes Windows Until Weather Clears

IF A drop of water hits the grid marked by the arrow at right, the house windows shut tight until the grid dries. Then it reopens the jalousies. The unit, similar to those on convertibles, is made by Micro-Moisture Controls, 3162 N. Miami Ave., Miami.



Slicing Machine Cuts Wire

WITH this tool airplane assembly workers slice wires to size instead of hand-snipping them. In 18½ hours they can crank out 67,824 pieces—a job that used to take 452 hours. T. J. Kittrell, bench mechanic of Temco Aircraft, Dallas, devised the machine.

Plug-in Filter Clears the Air

STATIC electricity—the same force that makes your nylon shirt crackle—has been harnessed to relieve hay fever. This portable filter sucks room air between charged plates that pick up pollen, dust, smoke, lint. Raytheon plans to market it next fall.

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Sunshine Becomes Electricity

Strips of silicon the size of razor blades yield more power than an atomic battery.

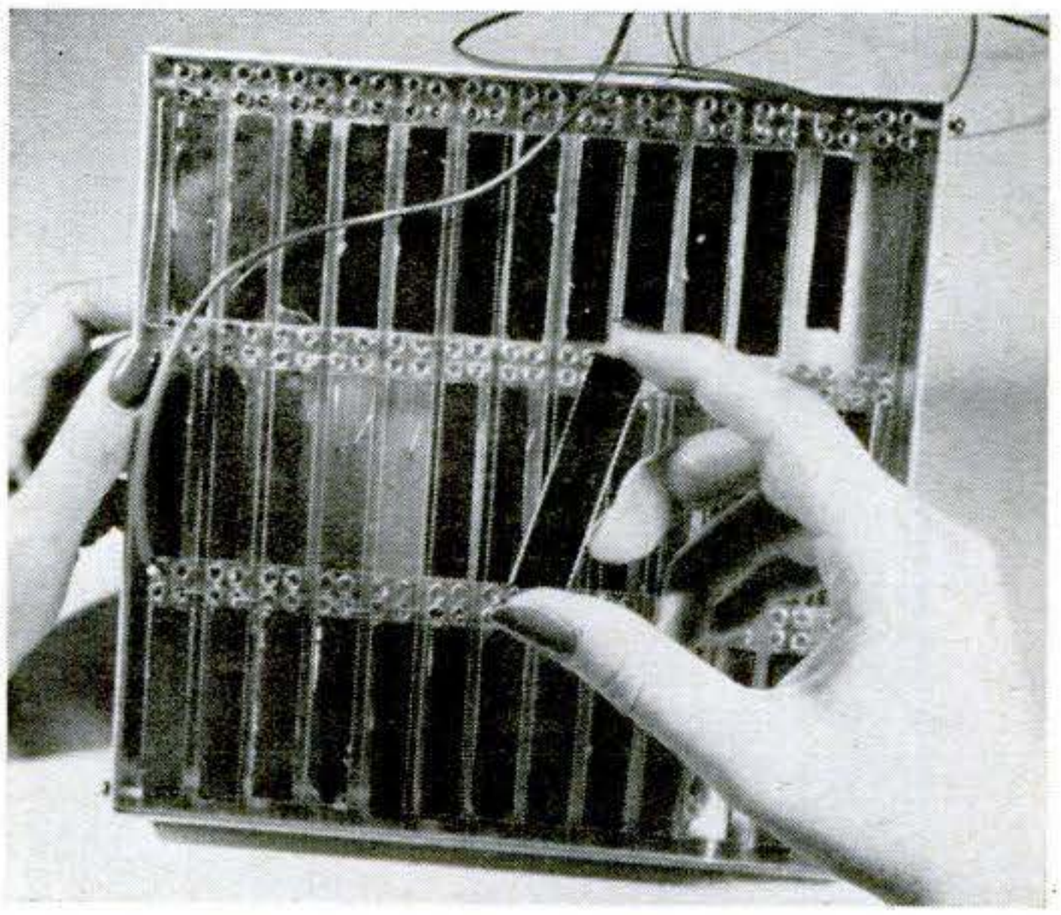
THERE'S something really new under this summer's sun. It's about half the size of this magazine, and it "taps" sunlight for electricity. It yields enough power to operate a transmitter, run a little motor or make a phone call.

Directly, instantly and efficiently, it transforms solar energy into electrical power. When light shines on it, you can use it just as though it were a dry battery; when the light goes out, it stops. It may never wear out.

On top of a telephone pole, it could be used to convert sunshine into power for the telephone line. It works on artificial light, too. Recently its inventors turned a spotlight on one in a dark room and made enough electricity to run a small motor that turned a toy Ferris wheel.

Credit for developing this astonishingly simple way of turning daylight, which is free, into electricity, which we usually buy, goes to a physicist, a chemist and an electrical engineer on the staff of the Bell Telephone Laboratories. The batteries which they showed to the National Academy of Sciences this spring delivered millions of times as much power as the atomic battery that was demonstrated a few weeks earlier (PSM, Apr. '54, p. 112). The makers of the solar battery believe, moreover, that its efficiency probably can be doubled.

Their discovery grew out of their study of semiconductors of electricity, and is based on a "p-n junction," which is used



THIS IS ONE OF THE FIRST solar batteries ever made. It consists of strips of specially treated silicon, which are connected together and mounted in plastic.

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THE THREE INVENTORS of the solar battery are (left to right): G. L. Pearson, a physicist; D. M. Chapin, an electrical engineer; and C. S. Fuller, a chemist.

in transistors. The "p" stands for positive, the "n" for negative, and the junction is a barrier between parts of the material that react oppositely. In this case, the material is silicon—a light, abundant element that looks metallic and is found in common sand.

First, the silicon is purified until the ratio of nonsilicon atoms in it is 1 to 10,000,000. Impurities are then put into it. These create a surplus of electrons throughout the stuff.

The next step is to treat slices of silicon in such a way that, instead of a surplus of electrons, there will be a scarcity of them on the surface of each slice. This is done by heating the silicon in a tube containing a different kind of impurity. The two different impurities cause the silicon to react differently when light strikes it; its surface becomes positive and its interior negative.

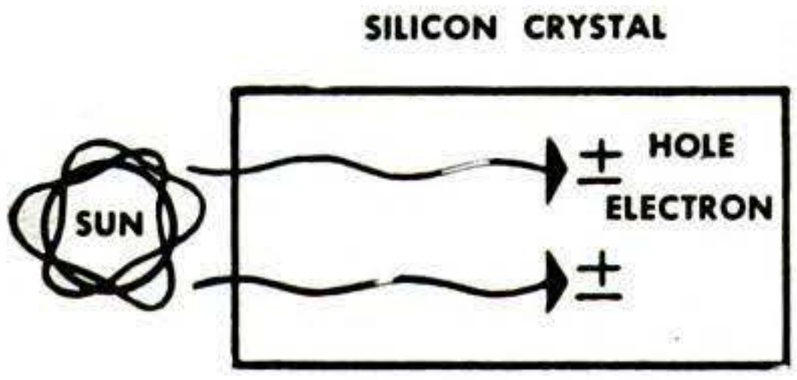
Tiny wires then are attached to the surface, and to the interior of each slice, and electricity is drawn through those wires whenever the silicon is exposed to light. By connecting many such slices together, 50 watts of power per square yard of surface can be drawn from sunlight.

Previous, comparable devices—thermocouples and photoelectric cells—have not converted more than one percent of light's energy into electricity; this new device utilizes six percent of the light. This compares favorably with the efficiency of steam and gasoline engines.

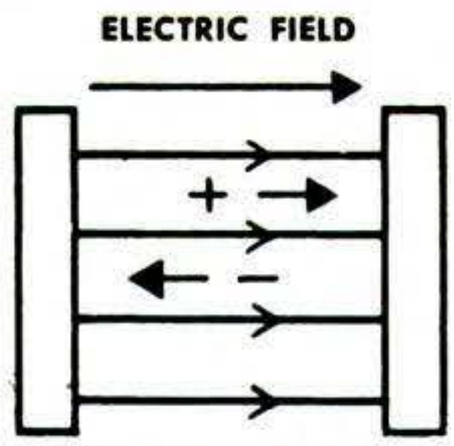
First Use for Telephones and Radios

The scientists expect these remarkable new batteries to be used first for rural telephone lines and low-power mobile radio apparatus. But many more uses may be found for them. Conceivably, at least, a roof built of strips of silicon will someday convert the sunlight shining on it into electricity to run the air-conditioner in the basement. The cost would be prohibitive now, but prices are man-made figures that men have often remade.—*Volta Torrey.*

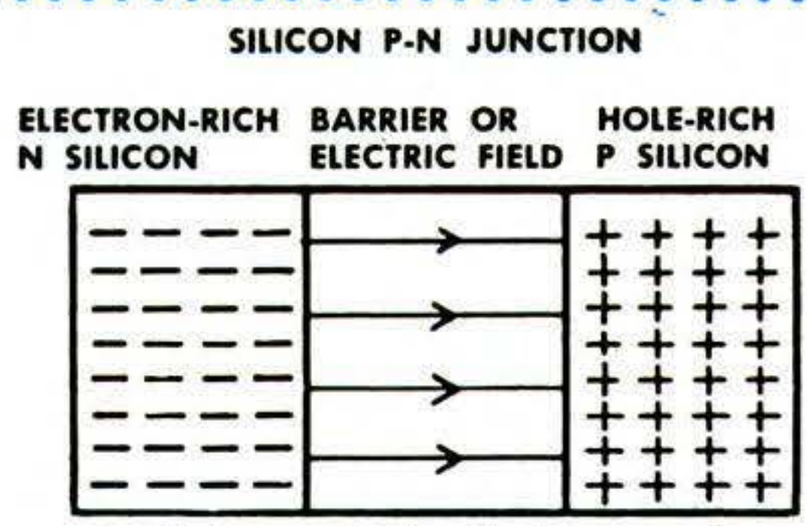
HOW THE SOLAR BATTERY WORKS



When light is absorbed by a silicon crystal, it liberates negative and positive charges inside the crystal. The negative charges are called electrons; the positive charges are called holes. Both electrons and holes are free to move around.

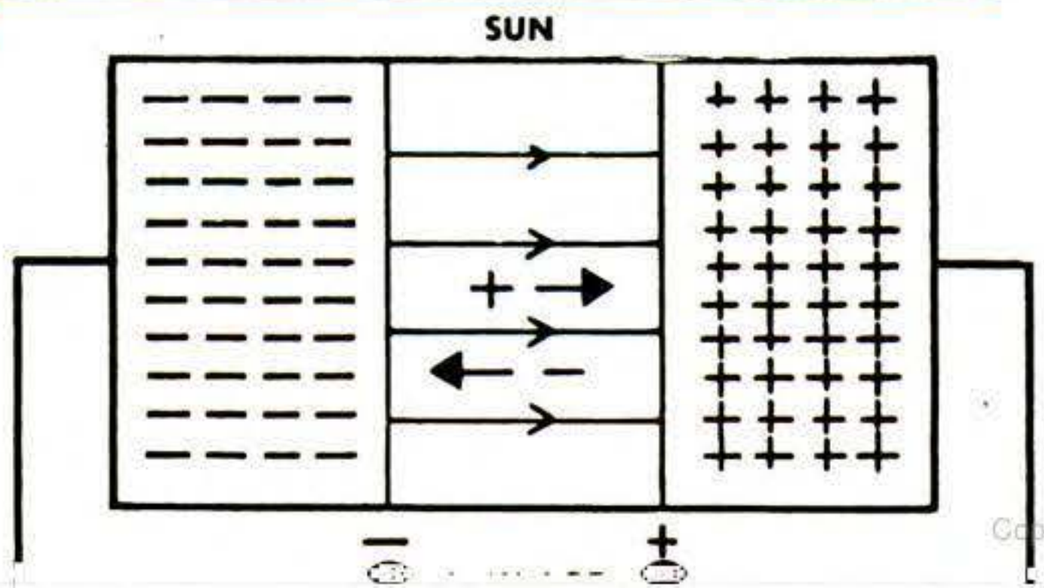


An electric field exerts a force on charged particles causing them to move if they are free. The force moves holes in one direction and electrons in the opposite direction.



In a thin barrier at the junction between an electron-rich n region and a hole-rich p region in a silicon crystal, a strong built-in electric field exists which keeps the electrons in the n side and holes in the p side.

When light is absorbed, liberating electrons and holes in the barrier region at a p-n junction, the built-in electric field forces the holes into the p side, making it positive, and the electrons into the n side, making it negative. This displacement of the newly freed charges causes a voltage to appear between the parts of the crystal, a voltage that is a source of electrical power. Thus light energy is converted into electrical energy.



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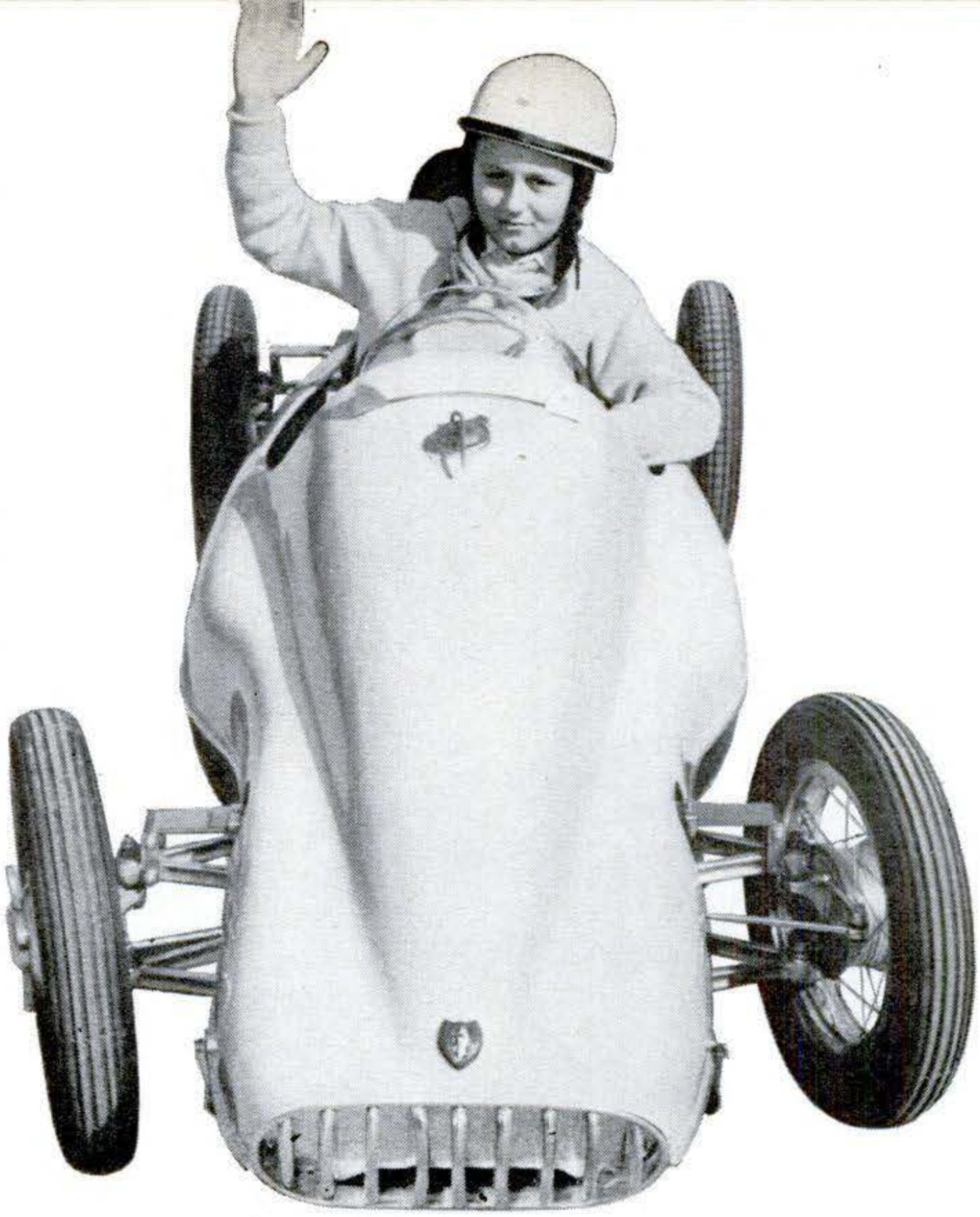
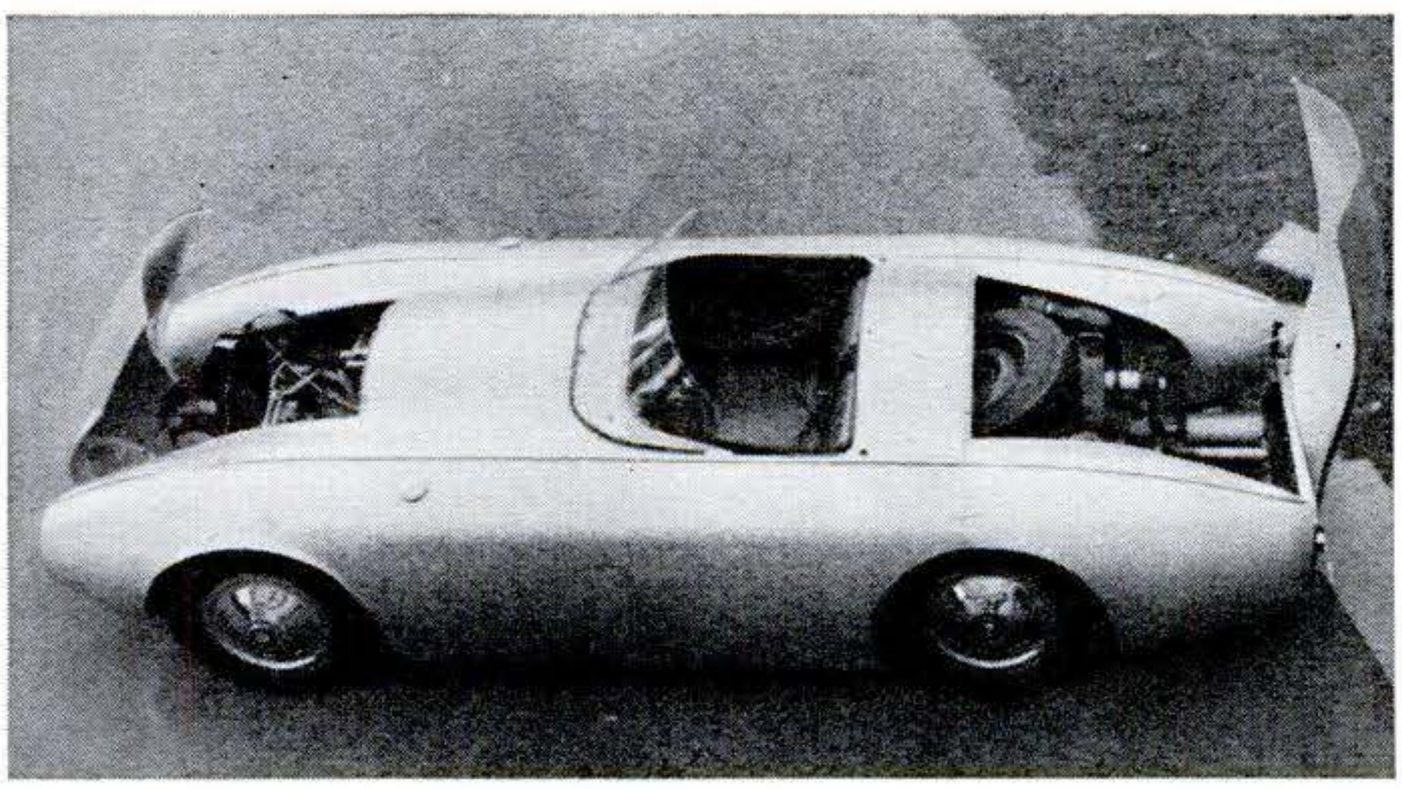
50-M.P.H. Racing Car Made for Kids

WHEN six-year-old Franco Patria of San Remo, Italy, gets behind the wheel of this miniature racer and guns the motor, he can whoop around a track at 50 miles an hour. But don't let your youngster get too enthusiastic. It would lower the family bank roll almost $1,000 to put the expensive toy in your garage. Franco's Pop, Piero Patria, makes the car.

▶▶▶Mass production of U.S. cars depends on precise timing. In GM. plants, for instance, it's not unusual to have on hand only a day and a half's supply of parts. Fast transportation from supply sources cuts storage—bits and pieces come in, cars go out.





Auto Has Engines at Front *and* Rear

THE sports car at left lifts two bonnets to show twin power plants—stock engines that deliver 72 hp. each. L. J. Fageol, bus manufacturer, reworked the Porsche. He says two engines prevent spin when cornering at high speeds. In shakedown race, car placed second.

Volkswagen Souped Up to Hit 100 M.P.H.

AUSTRIANS say their souped-up Volkswagen (right) does 100 m.p.h. when hitting on all four cylinders of its air-cooled, rear-mounted engine. The aluminum sports-car body rides lower and is shorter and wider than the German original. The car sells for $3,000 in Vienna.

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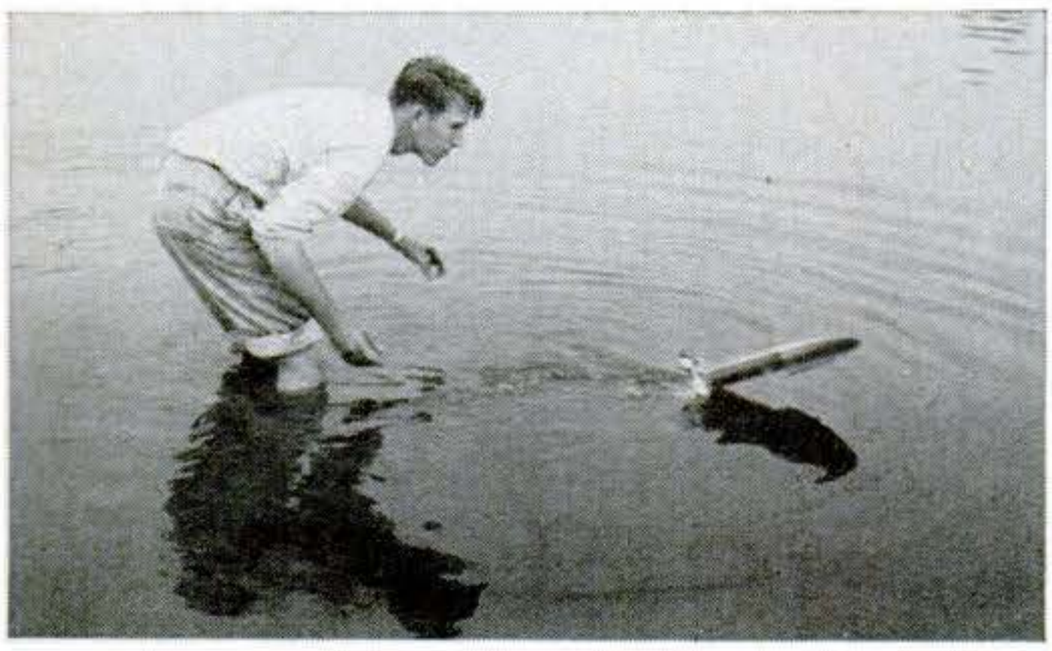
As the bow drops to planing position, little model lights out. Actual speed may be near 20

Tiny Outboards Howl Like the Big Ones

IF A small but perfectly formed outboard hydroplane, only a few inches long but able to scream nastily, overhauls you on the lake one of these days, there's no need to count your marbles. It's just one of the tiny new outboard models—latest adaptation of that incredibly tough little power plant, the model-plane engine—that have been delighting duck-pond sailors this summer.



OOPS! After a porpoise start, this model settled down to a fine high-speed run. Motor is often angled to drive boat in a large circle. Gas tank gives about a two-minute run.

Weighing less than five ounces complete, such an outboard has a genuine internal-combustion engine. The bore is roughly the diameter of a lead pencil; the stroke about the length of the eraser on the end; the displacement a piffling 1/20 of a cubic inch. Despite these mouse-scale dimensions, the tiny two-cycle job spits out about 1/32 hp. at 14,000 r.p.m., which can take a 14- to 24-inch boat up to 12 to 25 m.p.h.

Fuel is a mixture of methanol, castor oil and other agents. Ignition is by glow plug, a bit of resistance wire that's electrically heated for starting. The engine then carries on by self-ignition. Die-cast parts of light alloy account for both the light weight and low cost—under $10. Hobby shops are stocking, besides the engines, suitable hulls and hull kits.

Cautious owners run their craft tethered; more daring sailors try trans-pond "free-flights" or big semicircular cruises. How do you stop it after a run? A cinch —just pinch the flywheel!—*Jack Wilson.*

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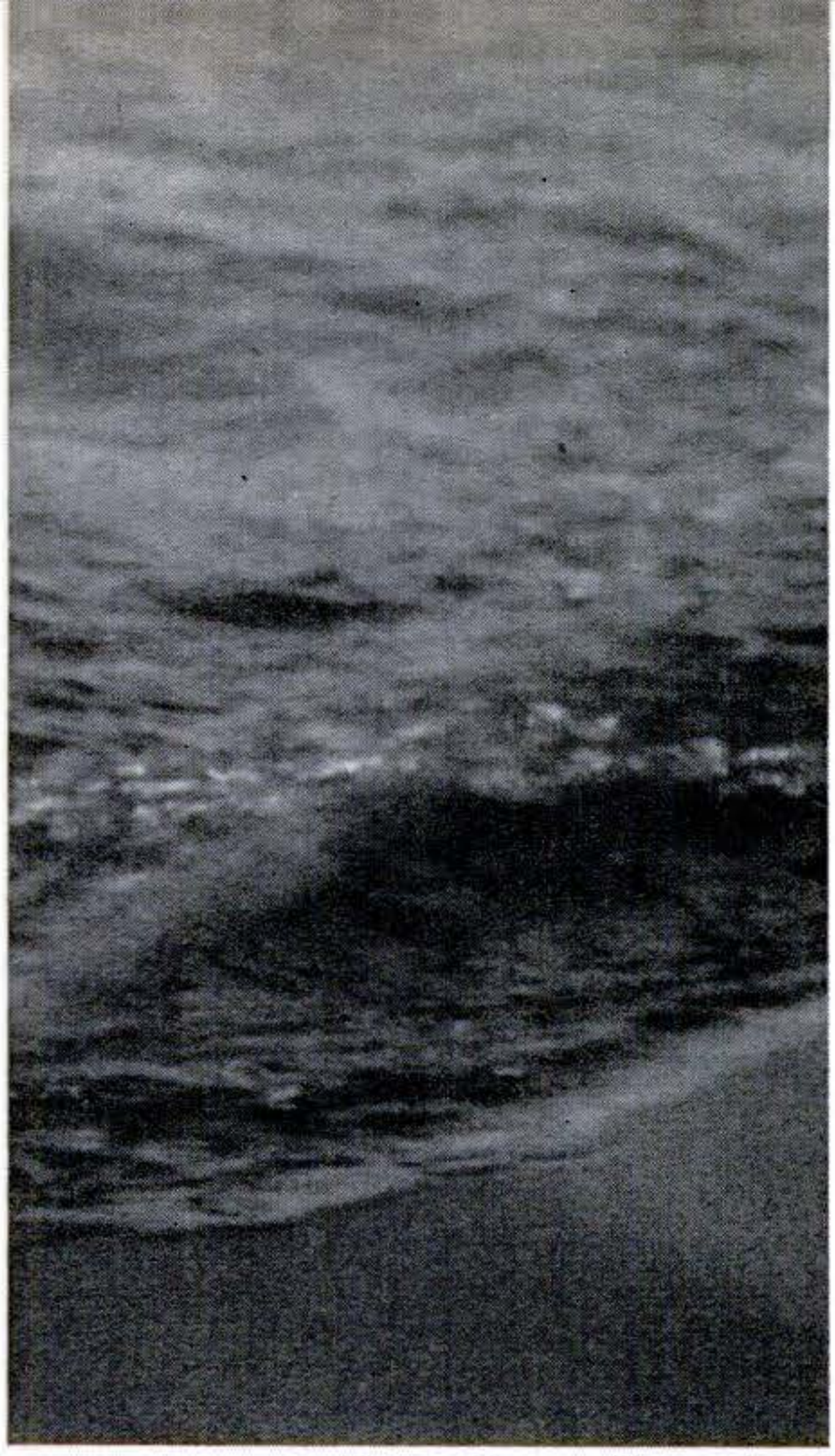
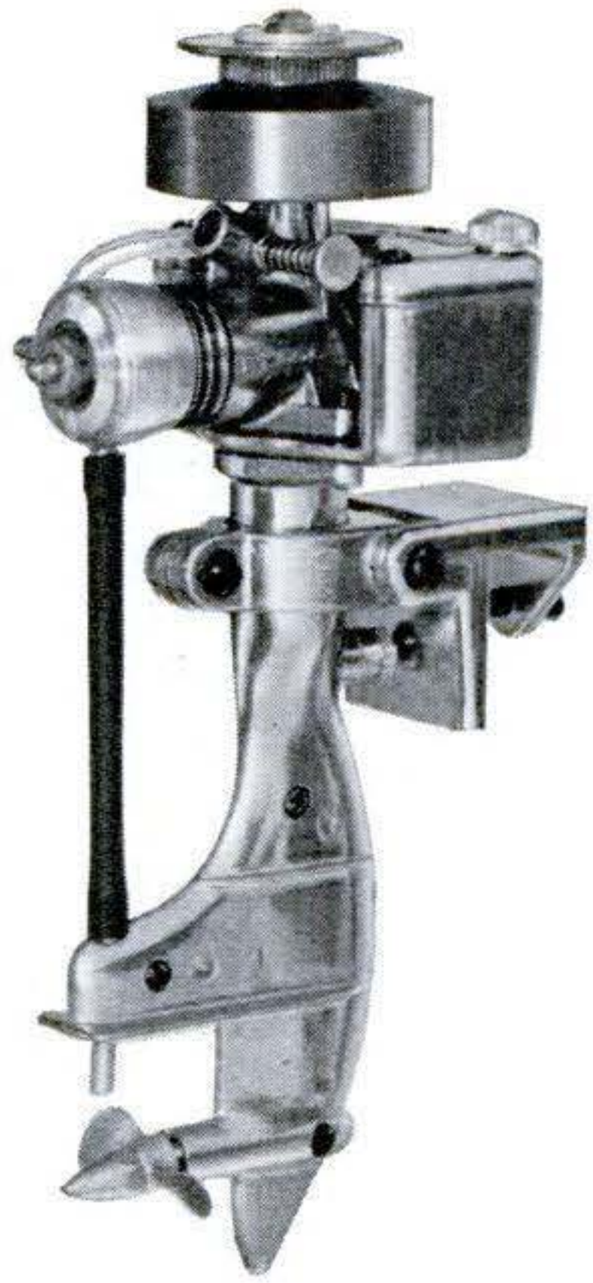
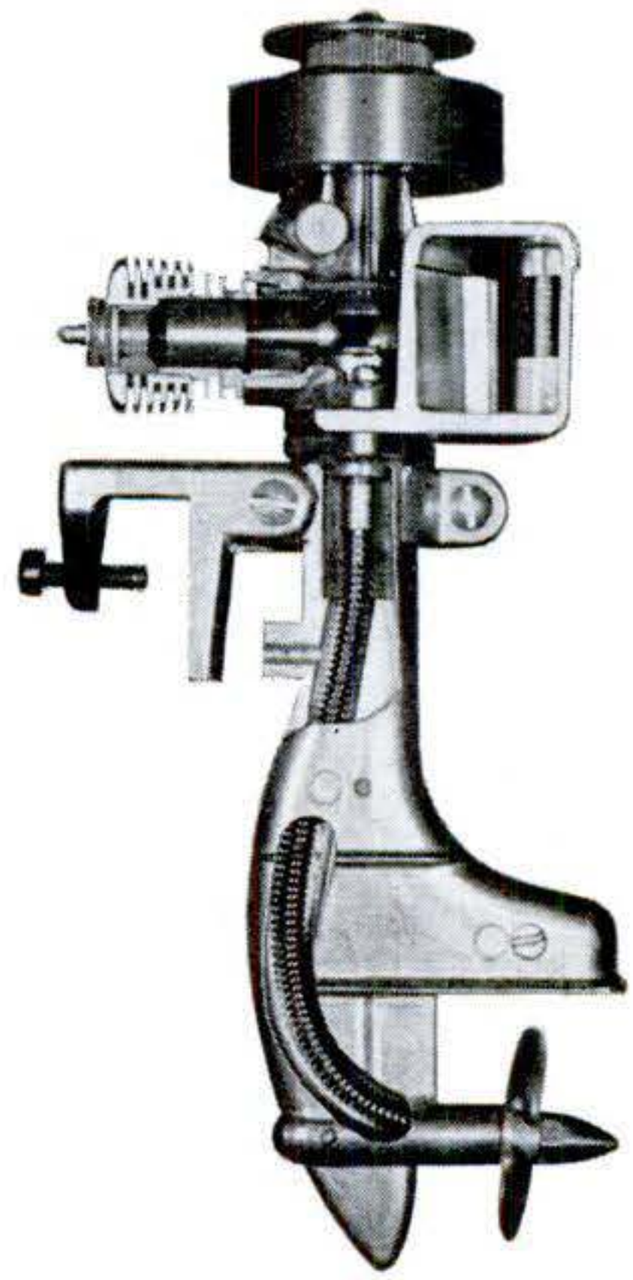
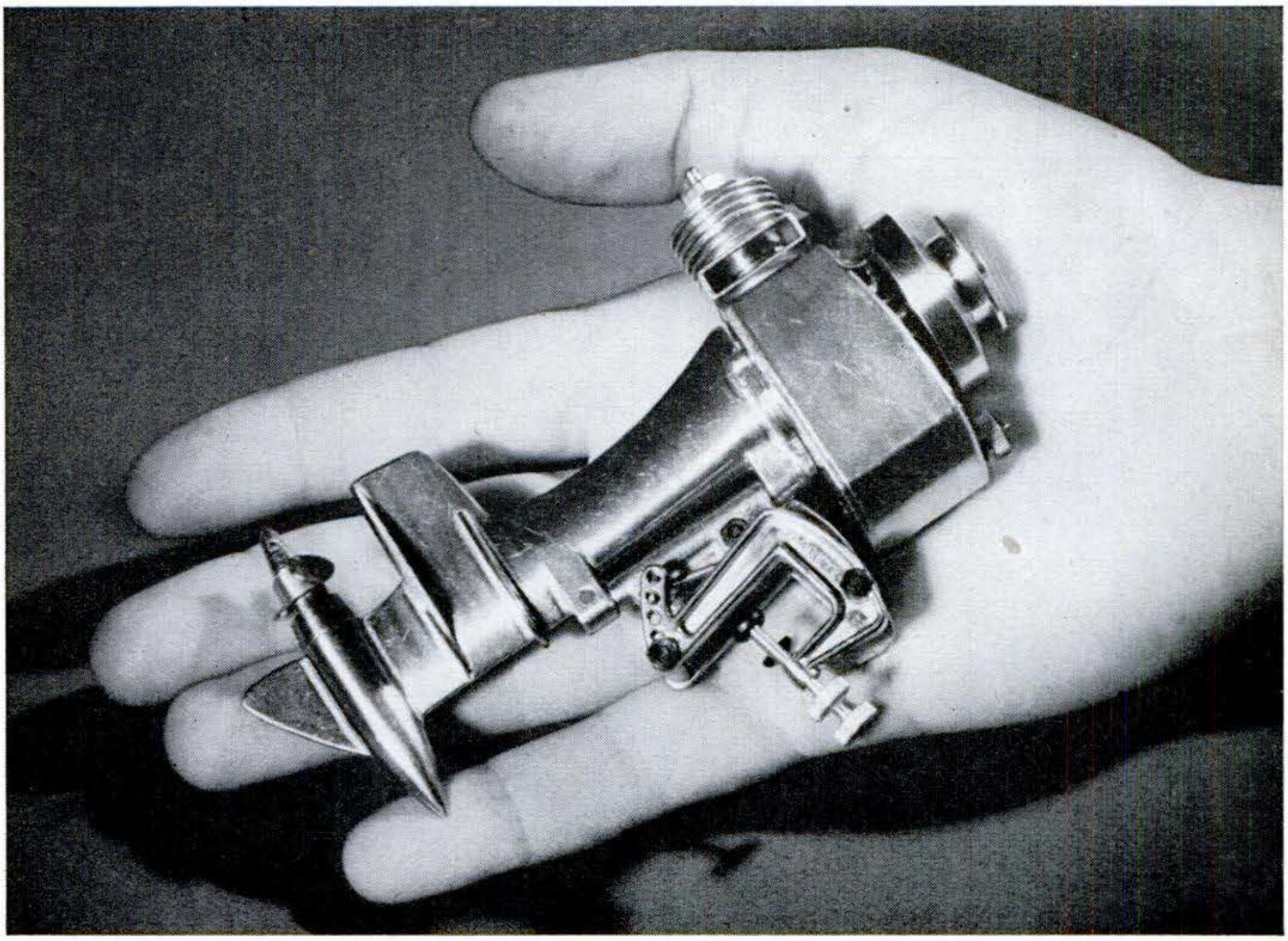


m.p.h.; scale speed over 100.





WATER-COOLED version (left, above) gets its circulation from the pressure of water astern of prop. The air-cooled version (right) works well on open hulls. Note in cutaway engine that this make (Atwood Motors) uses a flexible shaft to get power to prop. Photos above are half life-size.

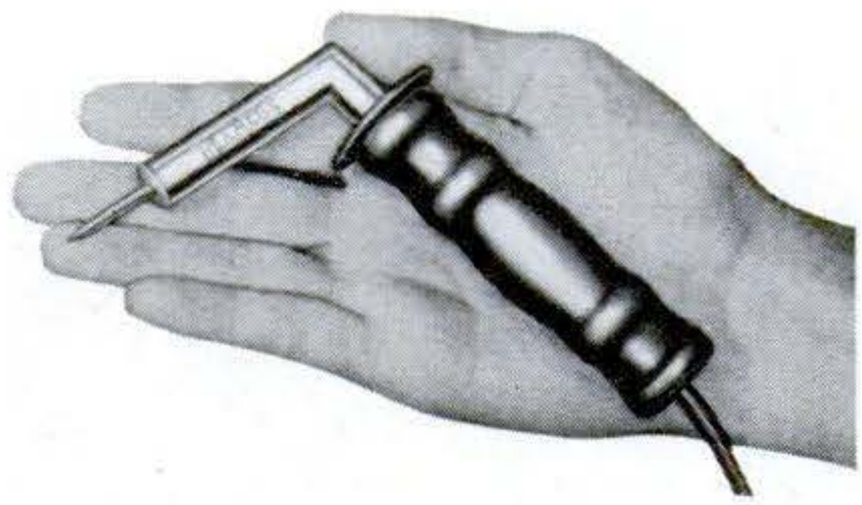


LIKE THE BIG ONES, some tiny kickers have two bevel gears in the underwater unit. This one, the Allyn Sea Fury, has rustless drive shaft and chrome-nickel bevel gears, driving a high-speed prop less than an inch in diameter. Adjustable mounting bracket suits various transoms. Needle valve gives speed control: extra-rich setting slows up the engine.

Copyrighted material

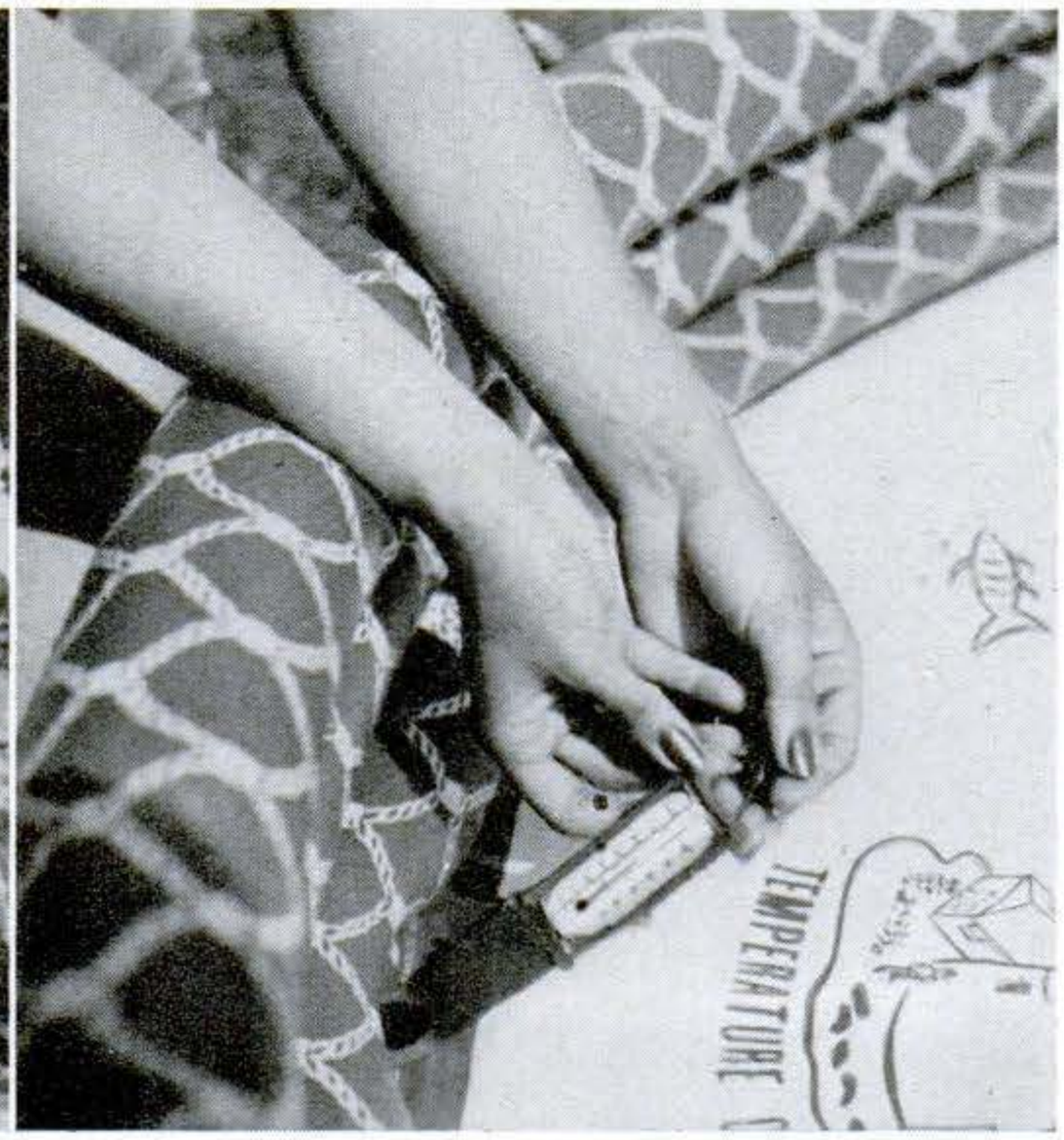
Movie Projector Has TV-Like Screen Built In

WHAT you see here is not a TV set with a tape recorder on top, but an 8-mm. movie projector with a built-in screen. It was exhibited at an international photographic show by the Vogt & Hartmann Electrical Co. of Mainz-Weisenau, Germany. It sells abroad for about $95.



Soldering Iron Fits Palm

A NEW three-ounce soldering iron is no bigger than your hand. Hexacon Electric Co., 115 W. Clay Ave., Roselle Park, N. J., says its shape makes accurate work on small electronic equipment easier.



Vacuum-Cleaner Connection Lets You Inflate Pool Without a Puff

YOU can pump up this wading pool with your vacuum cleaner. The same device that adapts a vacuum hose to the air valves also fits the drain, so that the pool can be emptied through a garden hose. A built-in thermometer lets Mother check water before dunking Junior. Bilnor Corp., 300 Morgan Ave., Brooklyn, N. Y., makes the pool.

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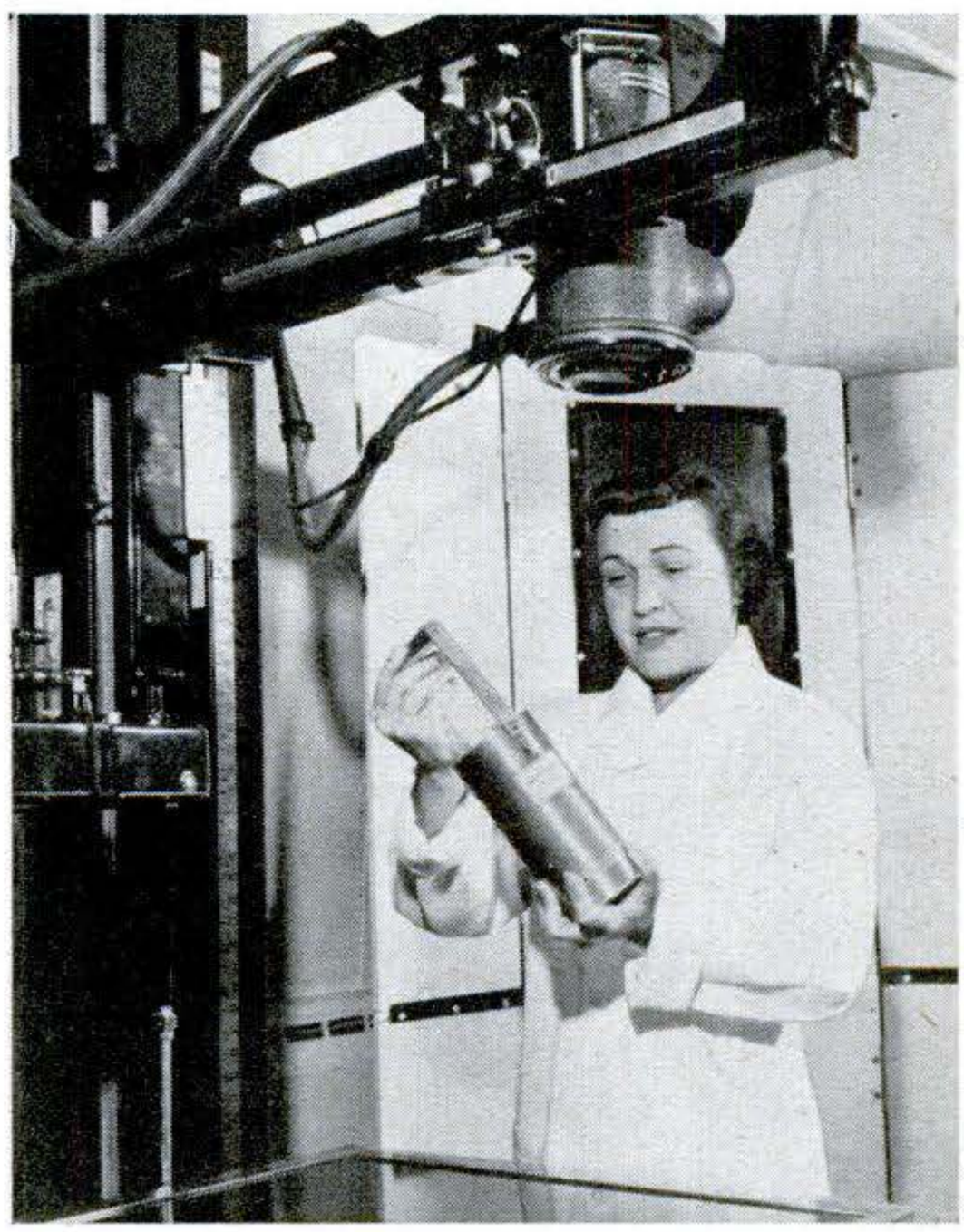
Automatic Control Waters Lawn Daily—Except When It Rains

FOR 80 bucks you can get this automatic water boy to sprinkle your lawn every day—except when it rains. A clock (left, above), connected to your concealed sprinkler system, turns the water on and off. But if it rains, a detector you fill with sand (right, above) stops sprinkling one day. Tork Clock Co., Mount Vernon, N. Y., makes it.

Professor Tells the Marines

A COLLEGE professor has gone and told it to the Marines. And of all things—how to use a bayonet. Prof. Armond H. Seidler, University of Illinois, has worked out a speedier bayonet technique that the Leathernecks are testing. That's the professor above showing a sergeant the new way.



Rare Element Generates X Rays

THE 10-pound X-ray machine above—about the size of a can of tomato juice—produces rays that put it in a class with the giant machine in the foreground. Radioactive thulium generates its rays and it needs no outside power source. The Argonne National Lab developed it.

Copyrighted material

Something new was added to astronomy six years ago, when scientists discovered the first radio "star." Now they are . . .

Looking into Space With Radio Eyes

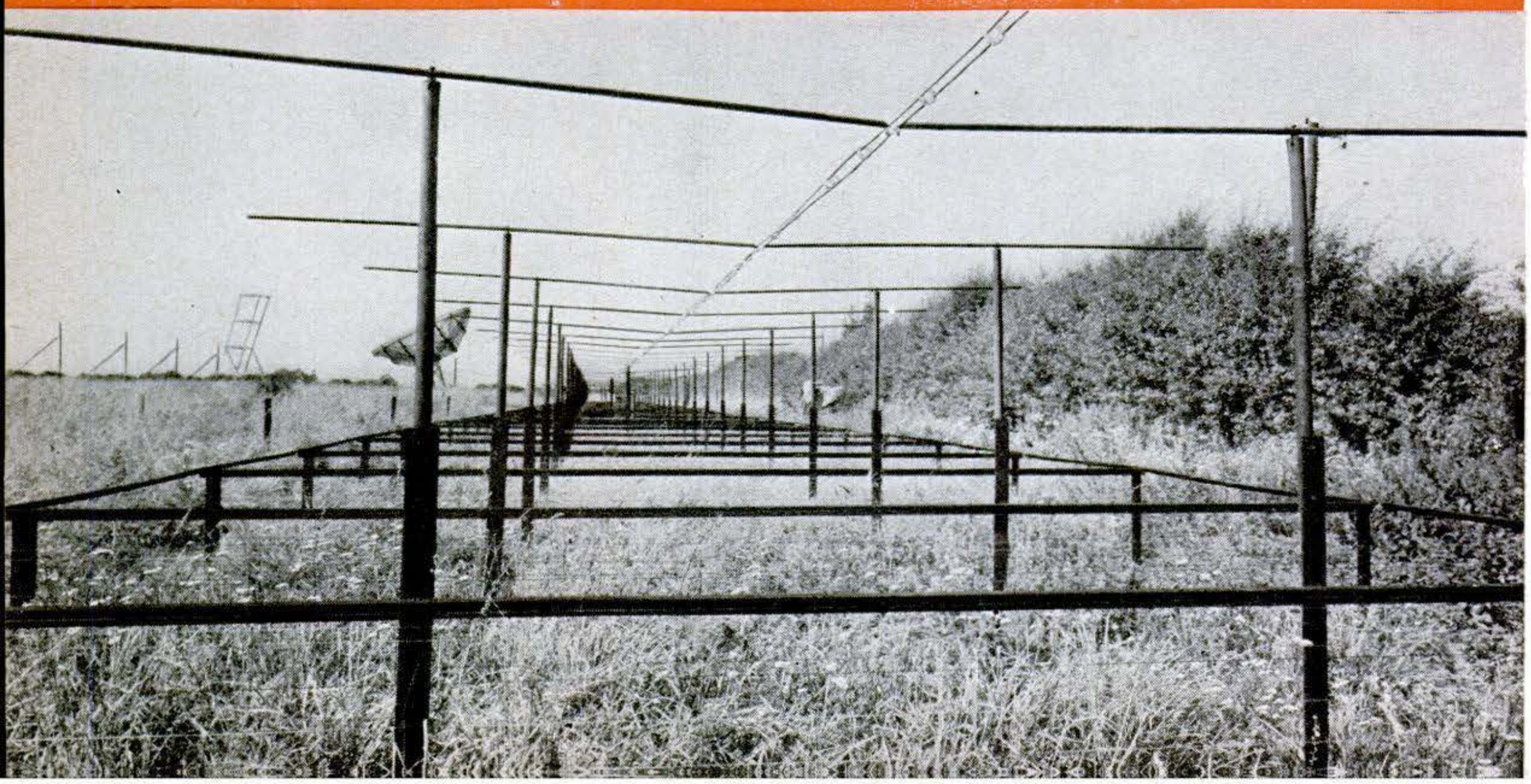
By P. A. O'Brien
Cavendish Laboratory, Cambridge

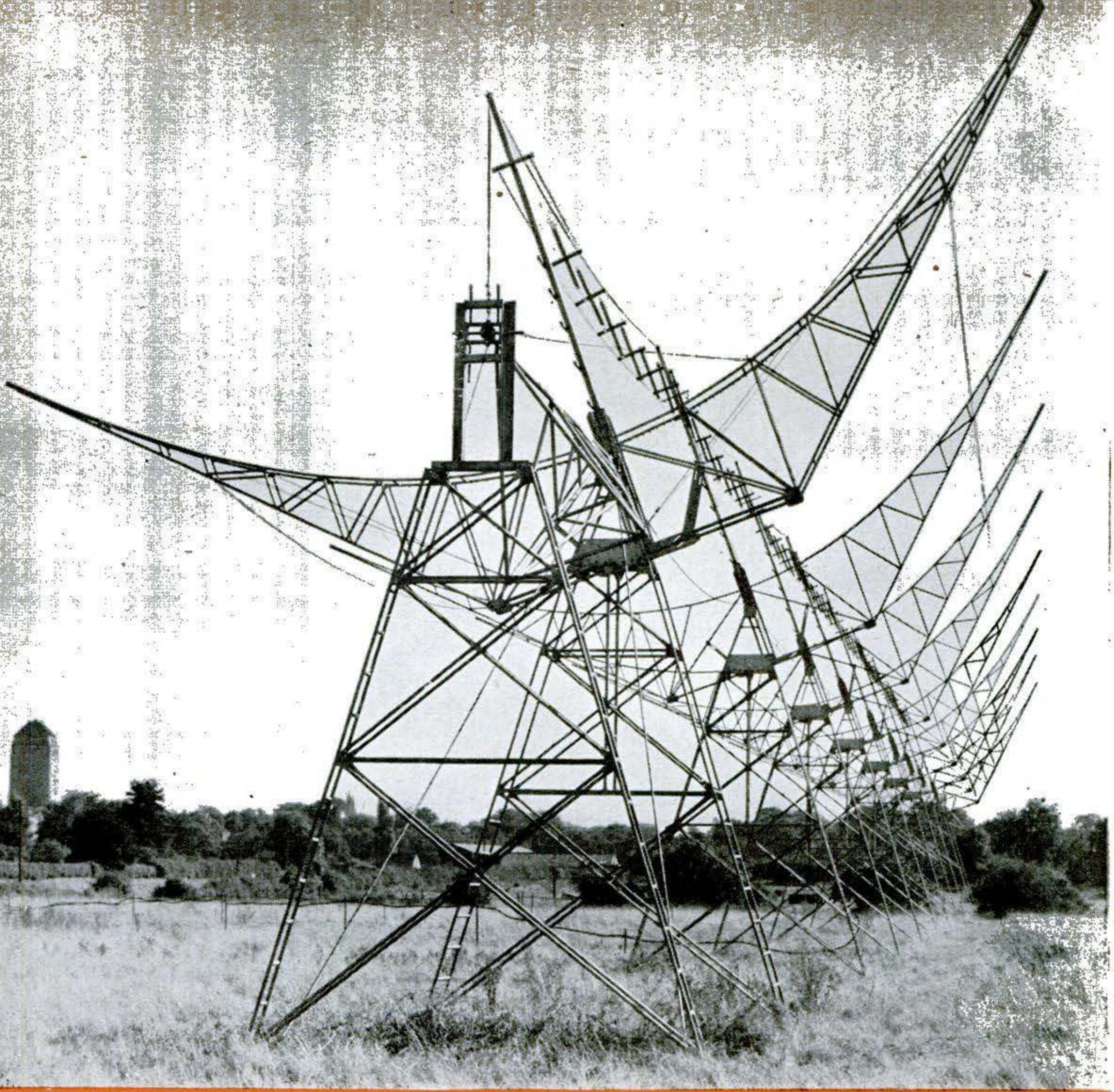
THE world's largest radio telescope has gone into service at Cambridge, England. Four parabolic sections, each 300 feet long and 40 feet wide, focus incoming radio waves upon antennas to locate radio "stars"—heavenly bodies that radiate at radio frequencies.

Radio astronomy is a new science. The first radio star was discovered in 1948. Now more than 200 are known; and Cambridge's new radio telescope should increase this number to about 1,000. Some actually are nebulae, but our sun, a faint radio star, is one example of a true star among them. They account for mysterious hissing radio noises from nowhere on earth, which observers since 1931 had tried to trace with the directional aerials called radio telescopes.

A new window into space opens to radio astronomy. Now astronomers can observe the skies by radio waves, as well as by visible, ultraviolet and infrared light. All are electromagnetic waves, differing only in wave length. And radio waves that pass unhindered through the earth's atmosphere, ranging in length from ¼ of an inch to 60 feet, offer a vast spectrum thousands of times as extensive as the visible one.

SURVEY of 50 radio "stars" in the Northern Hemisphere used pair of 240-foot aerials, one of which is seen below. Crab Nebula (photo at top of page) is one of the brightest.





LARGEST RADIO TELESCOPE peers into space at Cambridge, England. Four 300-foot parabolic sections like this one are arranged at the corners of a 160-by-1,800-foot rectangle.

Because of radio waves' similarity to light, a radio astronomer can do far more than listen to static from the stars. He views heavenly objects and makes actual pictures of them by radio "light."

Seeing the Sun by Radio

How does the sun "look" by radio? Its disk swells in apparent size. According to the wave length used, a bright ring may encircle it—or its shape may startlingly change from round to oval.

Sunspots, dark to the eye, become far brighter than the rest of the disk, vividly flickering and flaring.

The sun looks bigger by radio waves because they come mostly from its atmosphere—which we see only in a total eclipse, when scattered light from the sun's surface forms the faint pearly white corona. Appearance changes with wave lengths because different ones come from different heights. Radio astronomy unexpectedly finds the sun's upper atmosphere at million-degree temperature, compared to its 6,000-degree surface.

Many radio stars outshine the sun in radio "brightness." A bright one in the constellation of Cygnus, the Swan, was the first discovered, by Australian ob-

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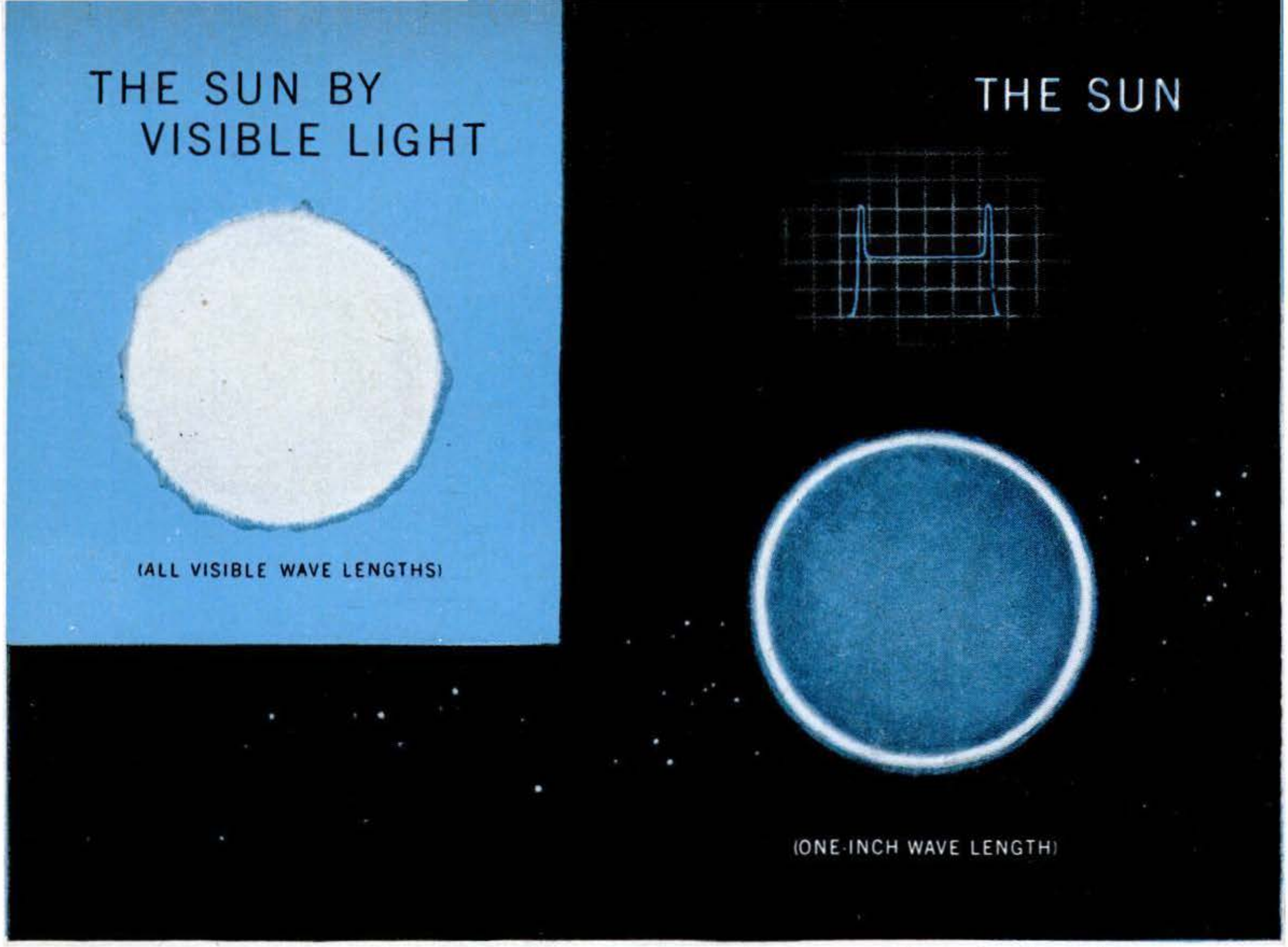

HERE'S THE NEW WAY the sun looks, by radio "light." Bigger than by visible light (far left), it enlarges with increasing wave length, and its round shape changes into an oval one (far right on facing page). Another striking feature is bright ring observed at one-inch wave length. PSM artist's paintings are based on brightness charts obtained with radio telescope and shown on smaller scale above them. Colors symbolize different wave lengths. This is an apt analogy, since changing the wave length alters celestial bodies' appearance much as a change of color filters does in visible-light observation. Note that visible sky is bright in daytime, "radio sky" always dark—a boon to radio astronomers.

servers. Soon after, the brightest of all was found in the constellation of Cassiopeia by Martin Ryle and his Cavendish Laboratory group at Cambridge.

Precise measurements at Cambridge of the two "stars'" positions were sent to Mt. Palomar, and photographs with the 200-inch telescope showed two strange objects faintly visible there.

New-Found Wonders of the Sky

The Cassiopeia radio star proves to be a nebulous, 100,000,000-mile-diameter Milky Way cloud in a chaotic state of turmoil, with filaments of gas moving at up to 1,000-mile-a-second velocity.

The Cygnus radio star looks like two distant galaxies in collision! Such swarms of stars might pass through each other unscathed, in millions of years; vast distances separating stars would make direct hits unlikely. But gas and dust clouds between stars could not escape collision. Most of the gas would be left behind at the scene, and heated to extreme temperature by the impact.

While radio astronomy led to finding these wonders, and more like them, some radio stars are familiar objects. The third-brightest radio star has been identified with the famous Crab Nebula in Taurus, the remains of a supernova or exploding star. Notably the brightest radio stars have one thing in common—diffuse gaseous matter in violent motion.

Day or night, the "radio sky" is dark and seeing is good for observers at radio telescopes. Neither clouds nor city lights bother them. But a handicap is their

[Continued on page 222]

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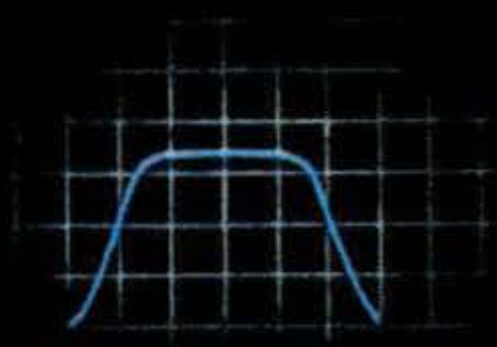
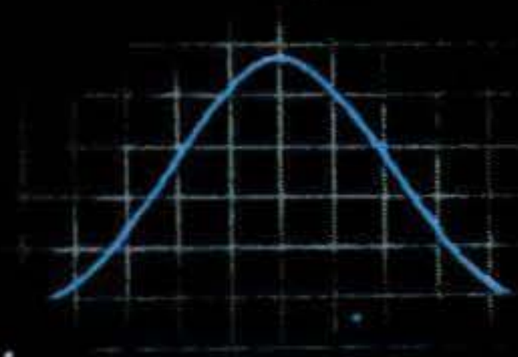
AS IT APPEARS BY RADIO "LIGHT"

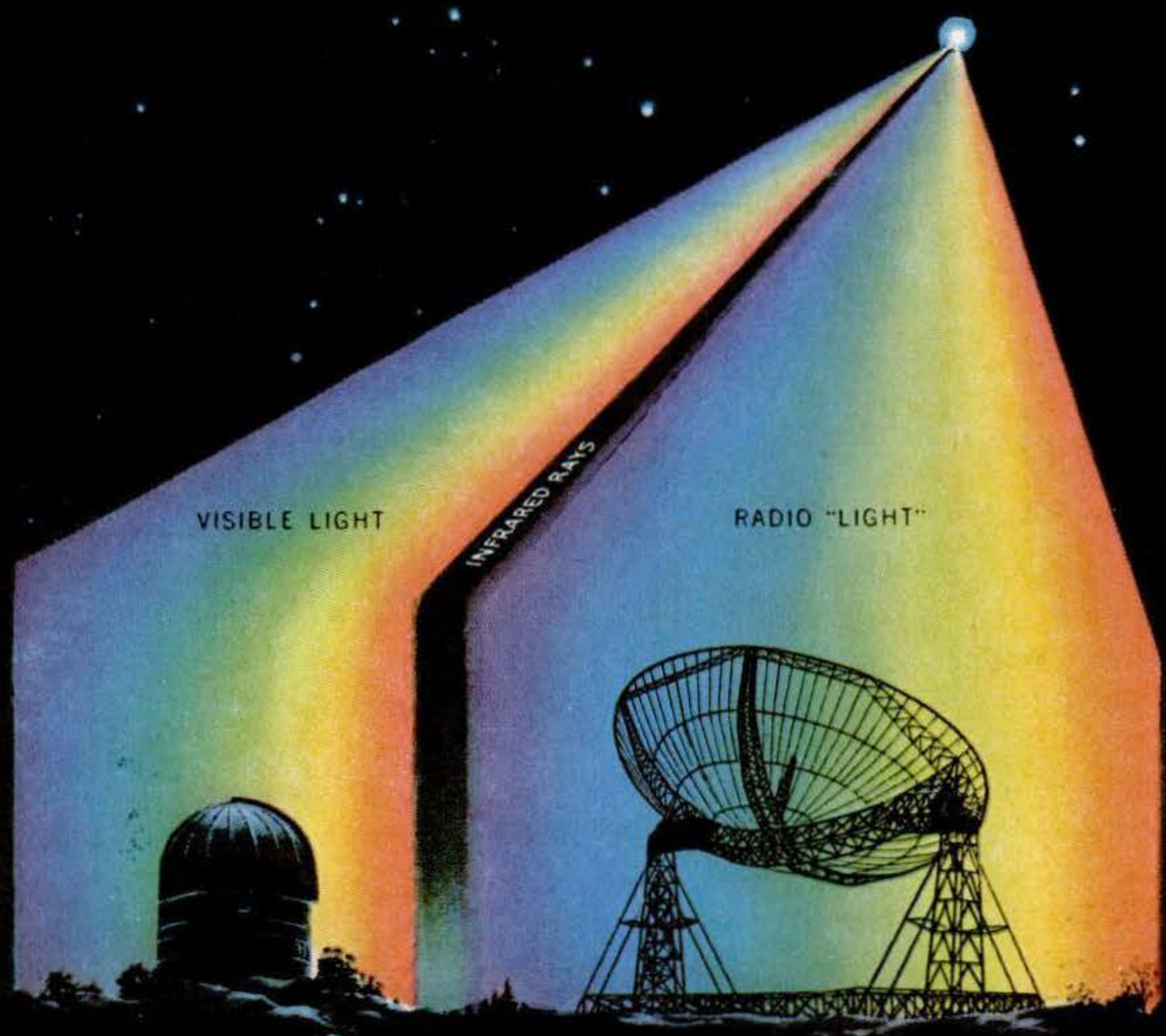




(25 INCH WAVE LENGTH)

(FIVE FOOT WAVE LENGTH)

RADIO "LIGHT," by which radio telescopes see, resembles visible light that optical telescopes use. Both are electromagnetic waves, differing only in wave length. Diagram below shows where they fit into a continuous spectrum, with wave length increasing from left to right. Radio "colors," really invisible, are pictured as if like visible hues. So far does radio band exceed visible one in extent, that drawing cannot be to scale.



OPTICAL TELESCOPE

RADIO TELESCOPE

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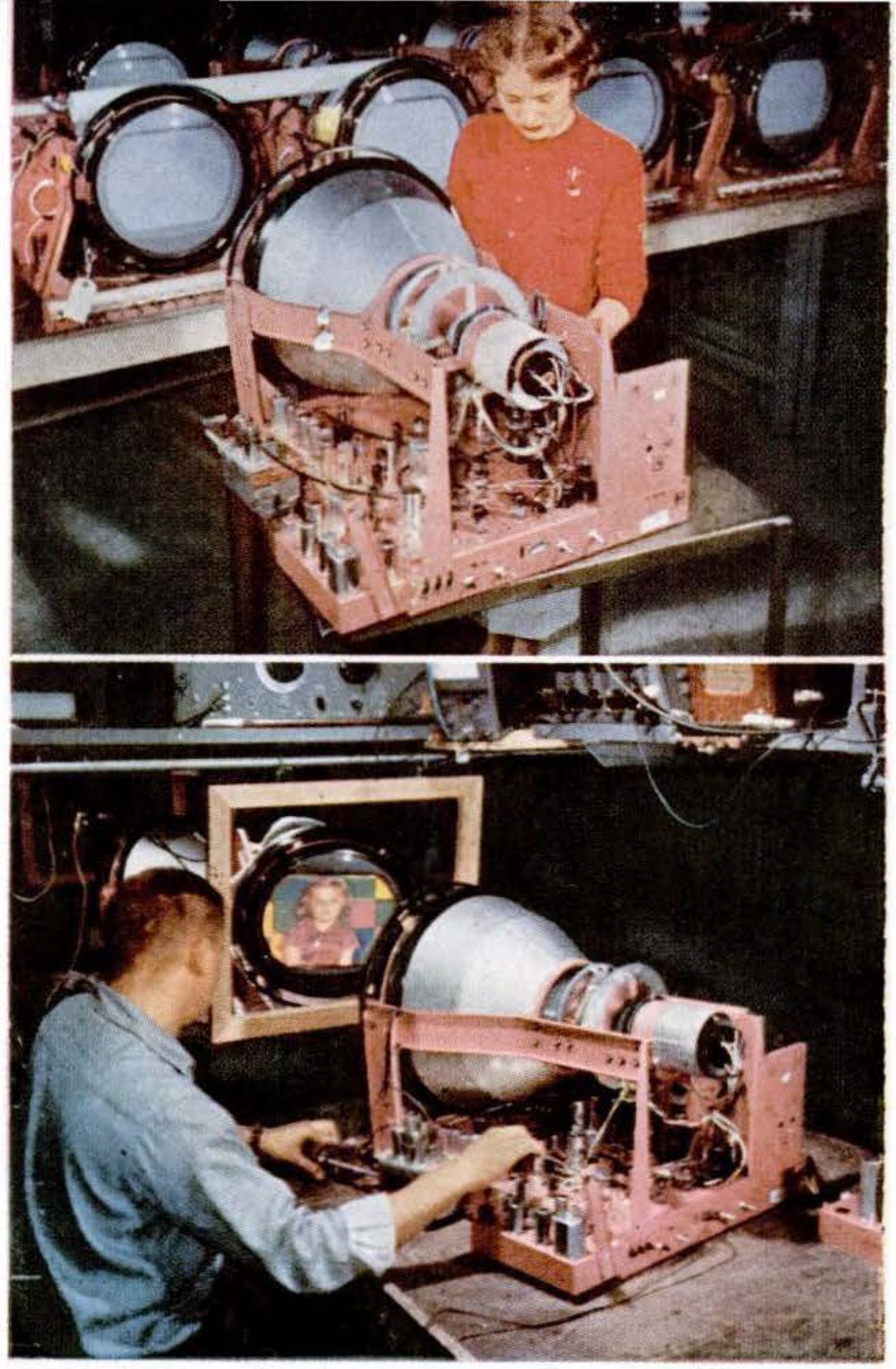
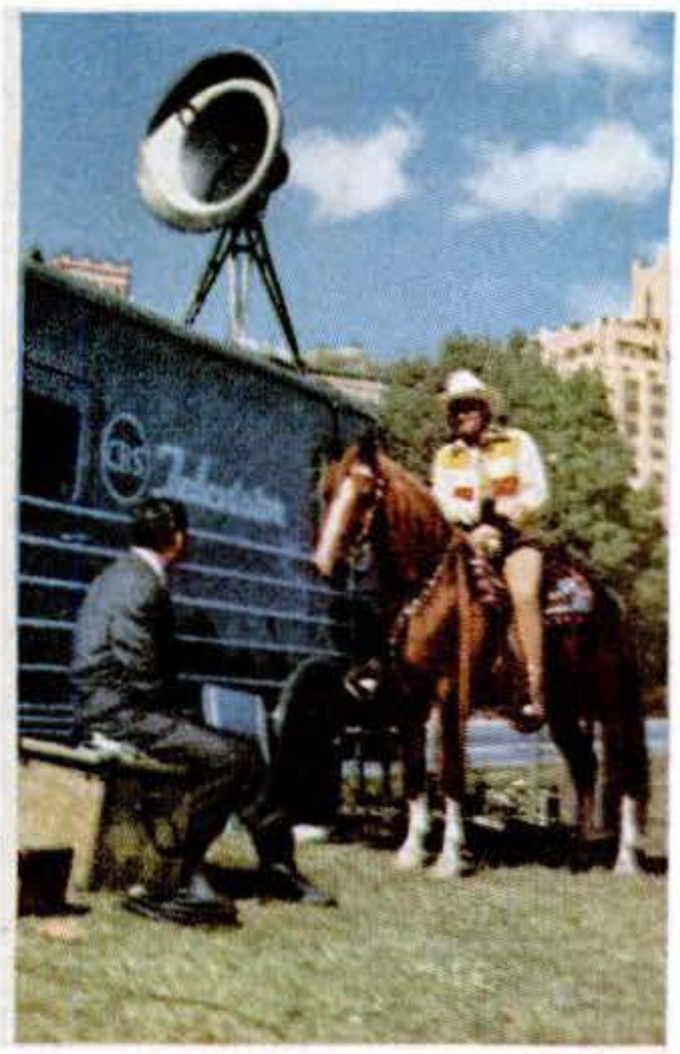
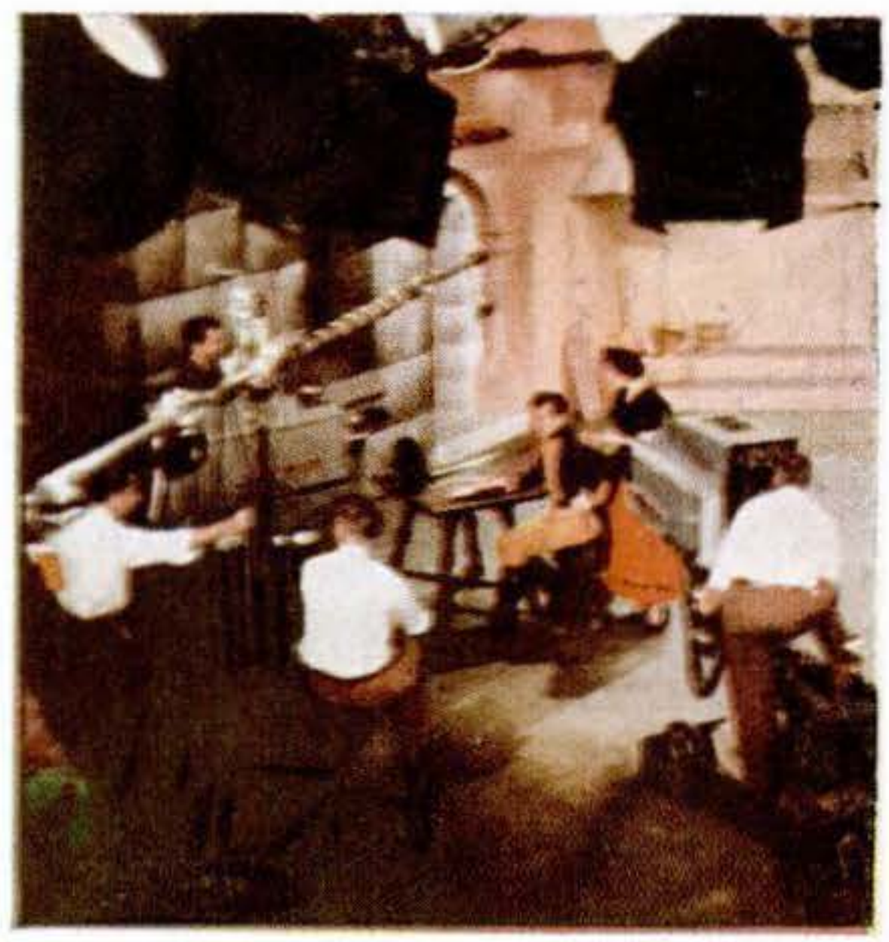
From horse opera to Carmen, *color TV has already run the gamut of video entertainment. NBC has done regular color shows one at a time, while CBS has concentrated on a weekly variety program. More ambitious schedules are in the works.*



COLOR SETS are in the stores now but are still costly (around $1,000). They must be care-



Jabberwocky? No, these are just the ABC's



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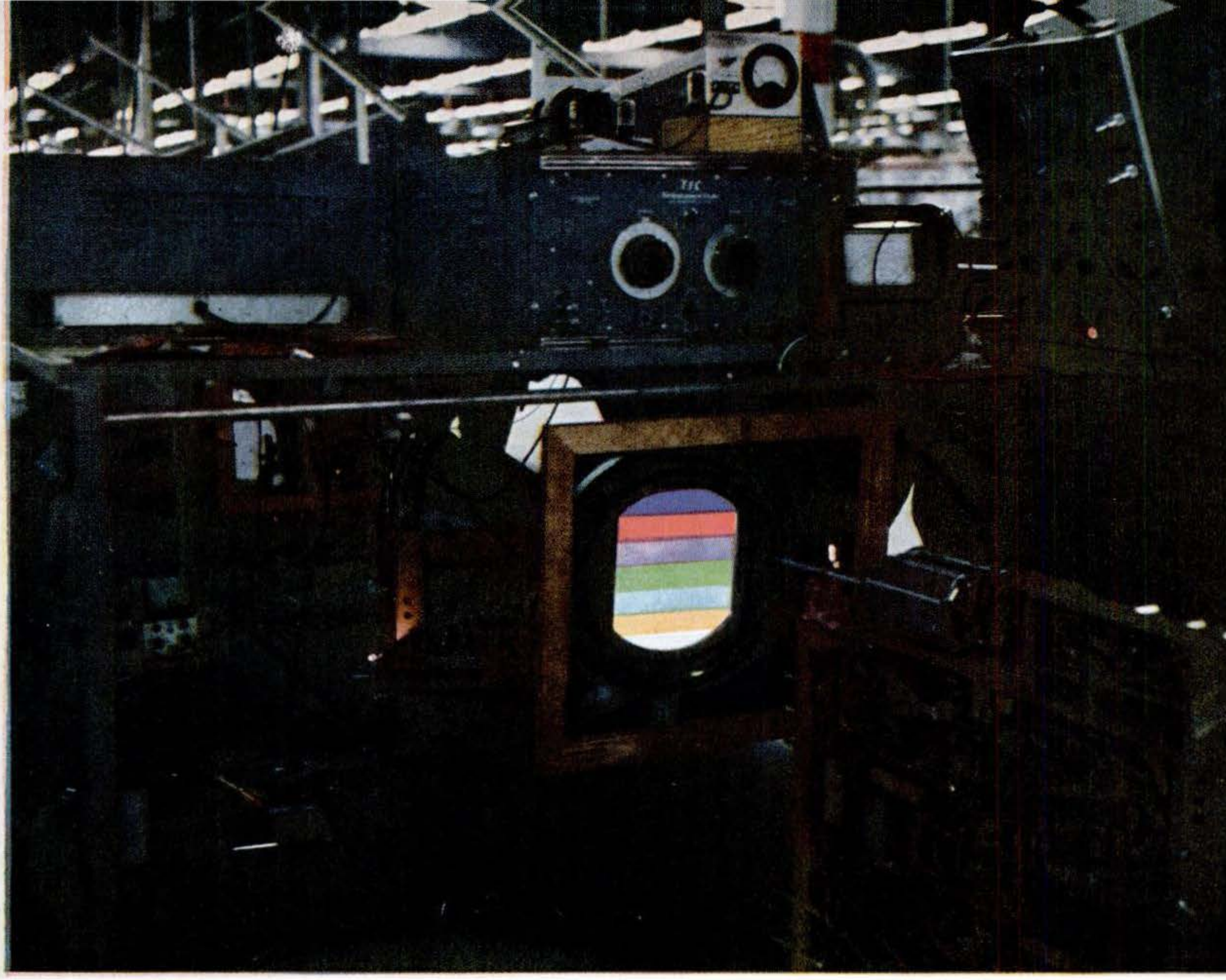

fully checked, as shown at left above in Westinghouse's Metuchen, N. J., factory. Vertical-bar test pattern shows up horizontal (above) because receiver is on its side.

# of Color Television

You, too, can tell a matrix from a killer with this glossary of the strange jargon that color TV is adding to our language.

By Martin Mann

GHOST, snow and channel do not necessarily refer, anymore, to the supernatural, precipation or waterways. Television has given these words new meanings. And more such changes in our language are coming, for color TV brings its own lively jargon. Some are new words, others just new meanings. But all are fun to know—and help show how this latest miracle of electronic entertainment is achieved.

Additive: Colors are created on a television screen by *adding* together different proportions of primary-colored lights. Red light plus green light gives yellow, for example. The lights are tiny dots of glowing colored phosphors on the face of the tube. This additive method is the opposite of the *subtractive* one used on

[Continued on page 212]

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Truck maneuvers are taught with toys before the students try to perform in the big rigs.

GETTING ACQUAINTED with the cockpit of one of the school's trucks. Students learn their lessons in three first-class combos, on loan.

CLOSE INSPECTION and understanding of the truck's innards help train the future driver to prevent trouble by anticipating it.

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THREE HOURS IN THE CLASSROOM each day are followed by five hours of practice, two hours of study. Students' performance is rated daily.

They Learn to Drive Trucks at College

A new course has been added to N. C. State's curriculum: the fine art of piloting a combo.

"THE old-line truck driver is on his way out. The bewhiskered, liquor-drinking, cursing roustabout is going."

The speaker was addressing a clean-shaven, sober, polite group of young men. They were graduating from North Carolina State College's Driver Training School. This college, the only one in the U.S. that offers a four-week course 12 times a year in how to pilot a tractor-trailer, has given a special diploma to more than 1,500 truck drivers since August 1949, when it began to teach them. Nearly all got jobs immediately.

The average student who pays the $125 tuition fee is 26, has a ninth-grade education and has never driven a truck before. He learns how, and in addition is taught everything from freight handling to courtesy. The training is said to be "20 percent below the shoulders, 80 percent above." Veteran drivers without a diploma were at first skeptical of the graduates but now often copy them.

On these pages and the two following, you see a typical class at its lessons.—*Wesley S. Griswold.*

DANGEROUS PRACTICE of crowding the highway's center line while crossing a bridge is pointed out to a pupil. He is told to brake his truck and politely let the road hog through.

MEASURING THE RESULTS of a dramatic test of driver reaction. With a detonator that discharges yellow powder on the road, the teacher finds out how quickly his pupil can stop.

FAKE BREAKDOWN is an excuse to show the boys how to set out signal flags and flares. They are taught first aid, accident reporting.

LOW, OVERHANGING LIMB impresses on the driver the need for watching his headroom as well as front, back and side clearances.

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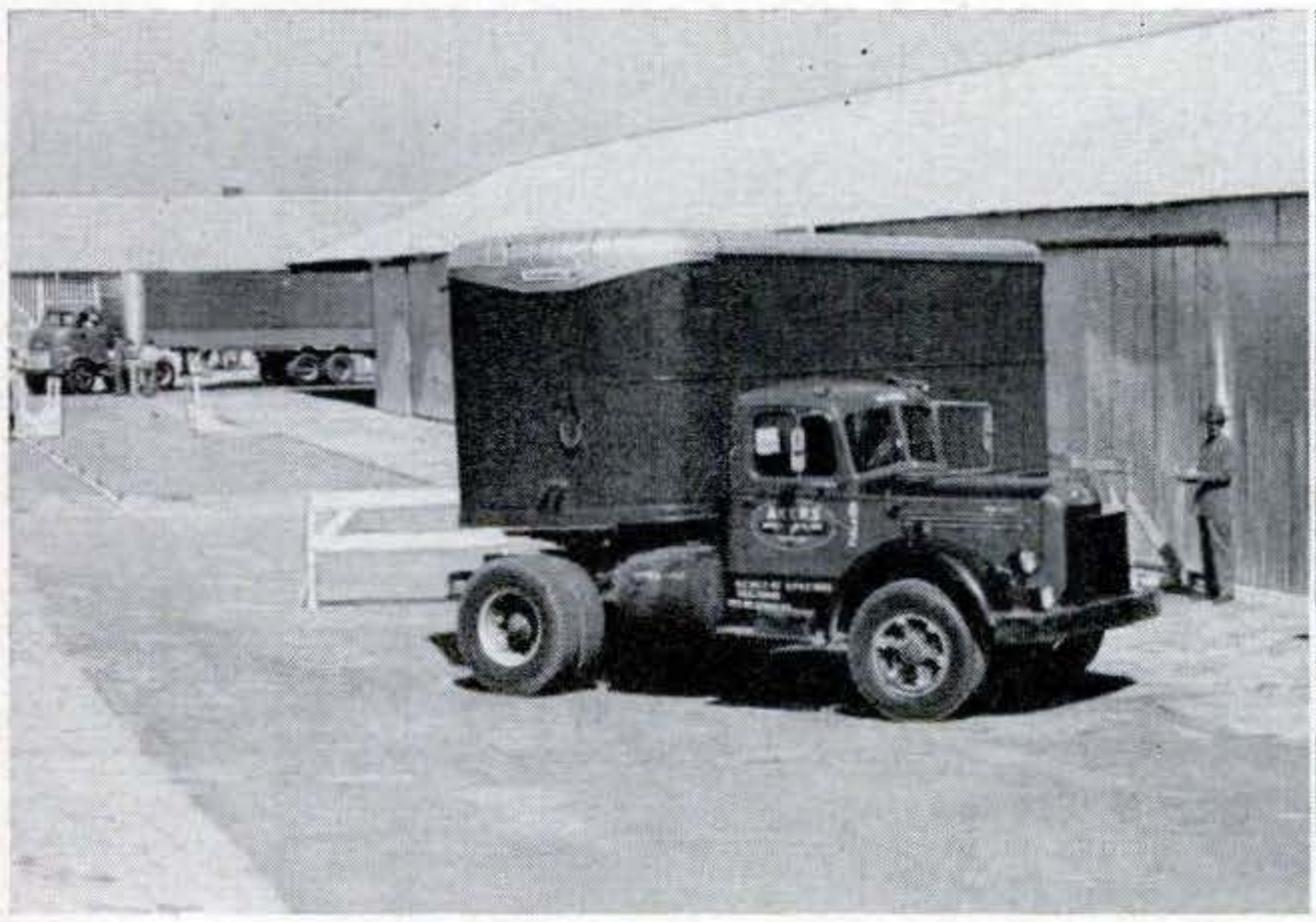
ONE OF THE HARDEST TESTS of skill and control is driving down this marked course, exactly the width of one highway lane, without knocking one tennis ball off its perch.



PARALLEL PARKING and other tricky exercises in parking and backing are practiced often on the State Fair grounds, outside Raleigh.

GRADUATION DAY is an occasion for feasting, and awarding of diplomas by Dean E. W. Ruggles of college's Extension Division. END

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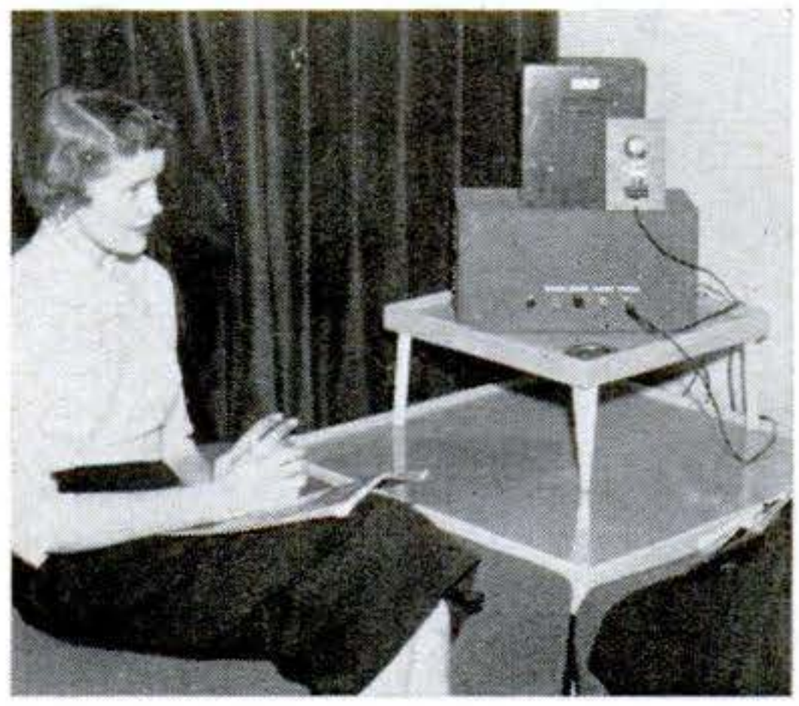
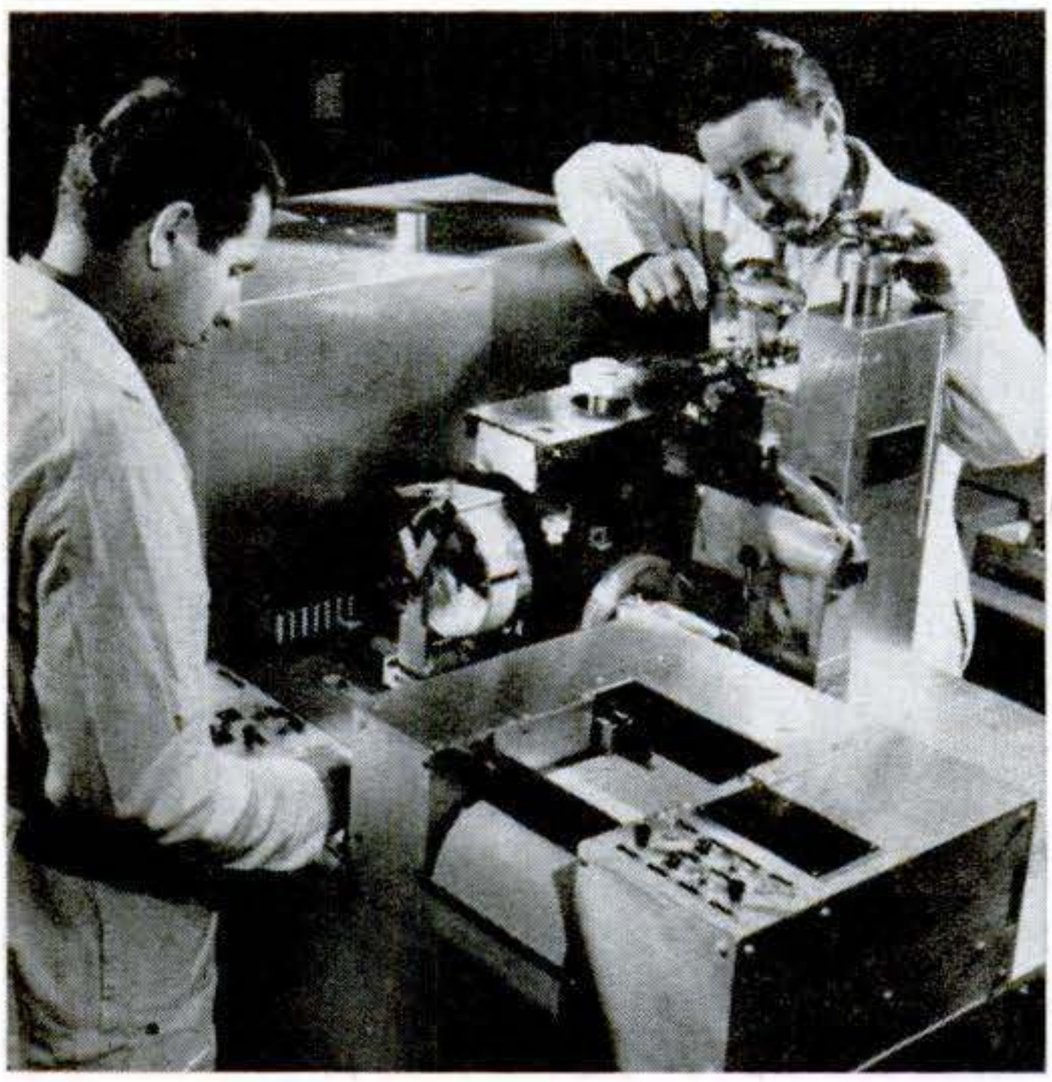
Observers Relax While "Ear" Listens for Plane

SKY watchers of the Ground Observer Corps may soon do their watching indoors with the metal bubble at left on duty outside. It listens for an approaching plane; when the noise builds to a certain volume, a buzzer indoors (below) sounds an alert. The system is now under test by the Air Defense Command.





Electric Finger Measures Parts

ENGINEERS use this Probograph to keep hard-to-measure, uneven parts and gears accurate to within 1/10,000 of an inch. It has a feeler that slides over the surface of the part, passing a tiny current through it while a stylus records the measurements in graph form. The GE men above are using the machine to check jet-engine parts.

Radio Turns Red Light Green

THAT'S an "electronic cop" on the door of the ambulance above. It will change red lights to green as the driver speeds toward intersections. Transmitting a beam to a receiver on each crossing light, the device cuts into the timing cycle to give the ambulance the right of way for five seconds. North American Aviation worked out the system.

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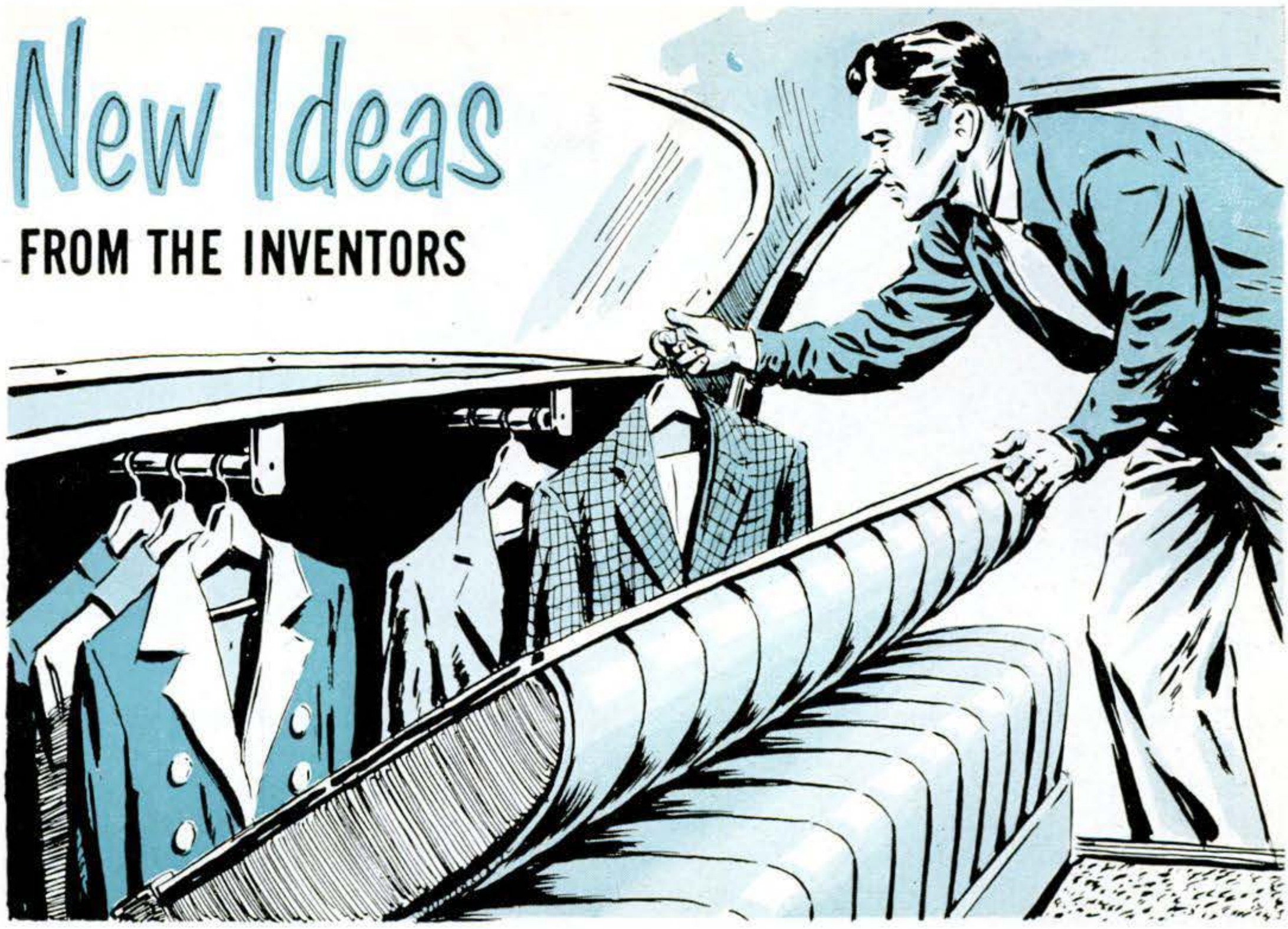
New Ideas

FROM THE INVENTORS



1 Car Closet to Hold Clothes. The clothes you take on a trip wouldn't get so wrinkled if your car had hanging space for them between the trunk and rear seat. Clearing garments off their usual perch on window hooks would also increase the comfort of back-seat riders and improve ventilation. Being out of sight, the clothing wouldn't invite pilferers, but a lock could be provided for extra protection.

2 Bridge to Adjust Bifocals. People who wear combination-lens spectacles might find it easier to get the right sections in focus if their glasses had sliding nose pads. Hooked under the regular bridge, this attachment would permit a wearer to raise or lower his lenses so he could see comfortably through either the lower or upper part.

3 Can Key to Prevent Tangles. A sealer strip of the kind used on coffee cans couldn't get fouled if you rolled it off with a key like this. A flange that followed the top of the can would keep the strip coiling evenly on itself. Sliding the guard down then would force the strip off the open-end slot and ready the key for re-use.

Please turn the page for more new ideas.

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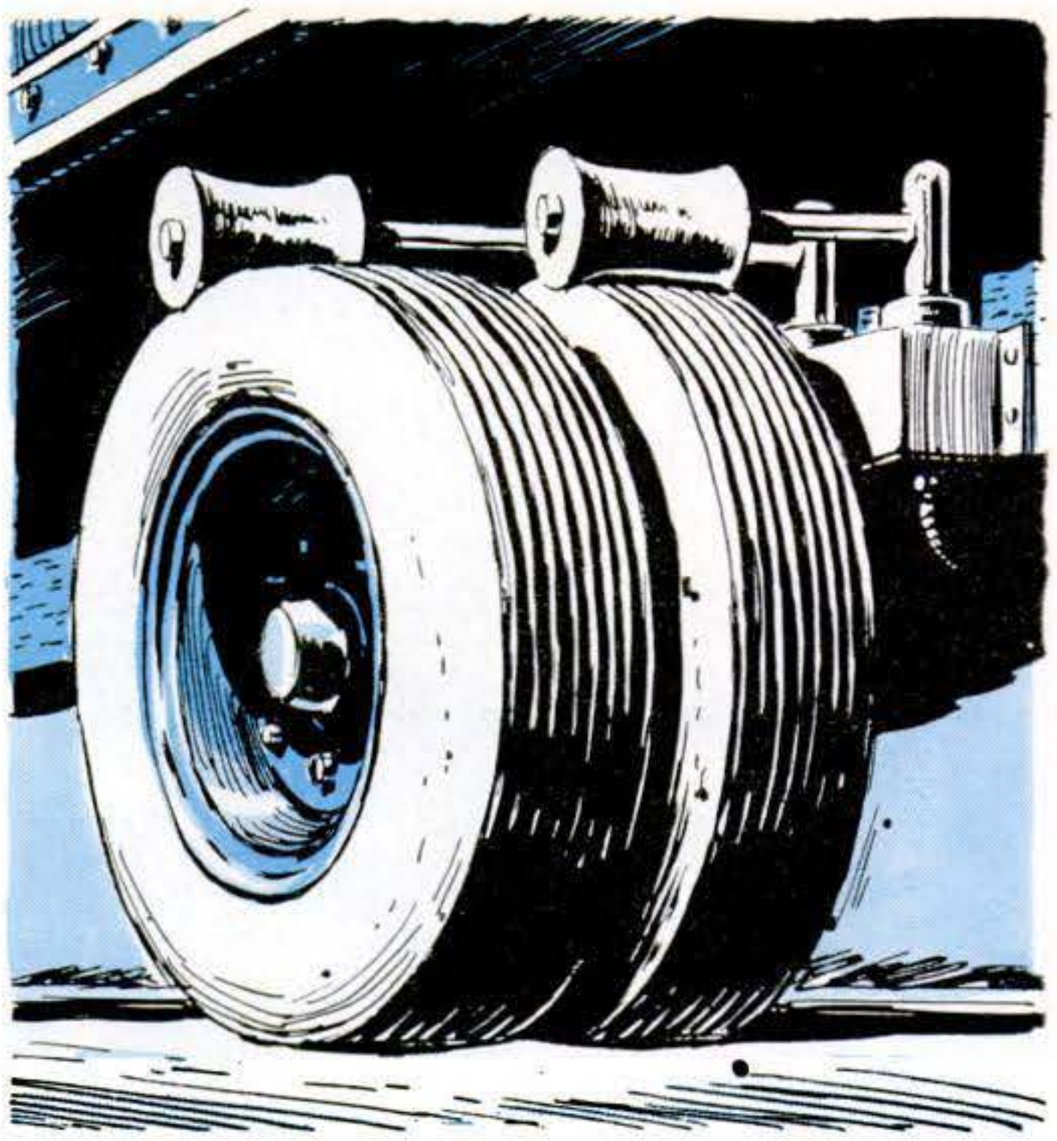
MORE New Ideas from the Inventors



4 Cushion to Air Minnows. Pumping air into a bait bucket, the inventor of this device notes, keeps minnows alive longer. Shifting your weight on this rubber seat pad would force air into the bucket. The pump would keep bait fresh while you drove to your fishing spot, and would save you the trouble of changing water while fishing.

5 Signal to Warn of Soft Tires. A pressure drop in one of the tires on a dual wheel can't usually be detected by inspection because the good tire keeps the bad one from sagging. This warning system would use a separate roller to follow each shoe. If any tire became soft, its roller would tip and close an electric signal circuit.

6 Outboard to Tow Swimmer. A new kind of water sport may make its appearance if this personal outboard becomes popular. To get in the swim, you'd only have to hold onto a bar and let a motor zip you along. Shifting your grip would steer the "boat." A conventional battery-type outboard motor would be fitted to a watertight upper chamber. The chamber would serve to float the device and keep battery dry.

U. S. patents on these inventions have been granted to: 1. S. Senk, Mullen, Nebr.; 2. R. F. E. Stegeman, Greece, N.Y.; 3. L. J. Lyle, Newton, Miss.; 4. J. J. Sunday, Detroit; 5. T. J. Finan, Detroit; 6. J. B. Waters, Niagara Falls, N.Y.; 7. W. S. Swift, East Rochester, N.Y.; 8. C. E. Royal, Lockhart, Tex.; 9. J. O. Vann, Arlington, Mass.

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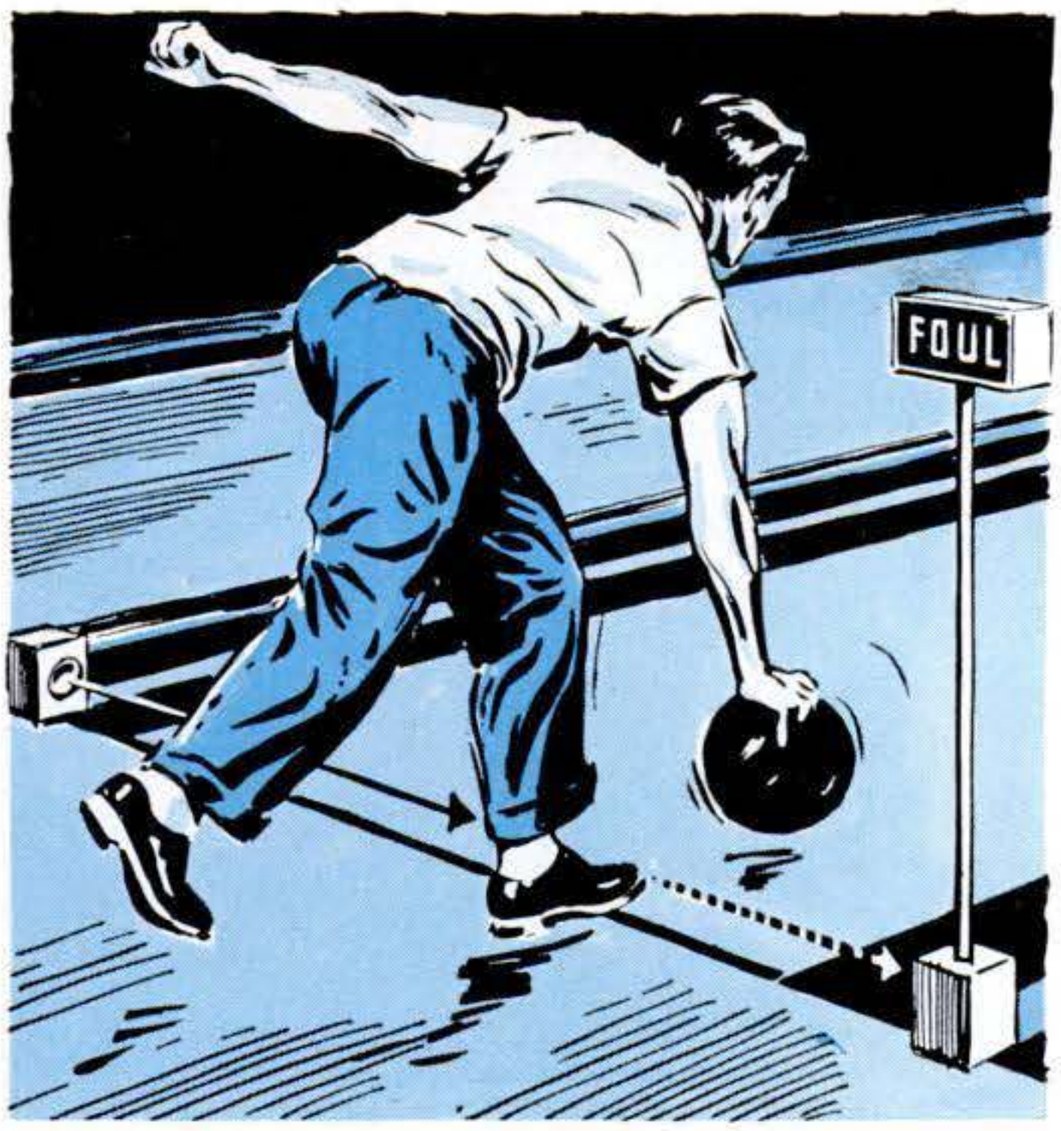

7 Light to Guard Foul Line. A bowler may overstep the foul line without even being aware of it, but this photoelectric eye would not be deceived. If any part of a shoe interrupted the light beam, the foul sign would flash on. A built-in delay circuit would keep the mechanism from being triggered by passage of the ball.

8 Drive-Ins to Air-Condition Cars. Cool or warm air might be piped to every car at a drive-in through underground ducts that would channel air from a central conditioning system to a hollow standard at each parking station. By lifting a flexible feeder hood into his car, a patron would connect his unit into the central system.

9 Ground Probe to Unhook Chute. This Air Force patent is designed to keep certain types of drop cargo from being overturned by drag of the chute after landing. A feeler probe that would touch ground a second or so in advance of its crate would set off a small explosive charge. This would sever the harness and release the chute.

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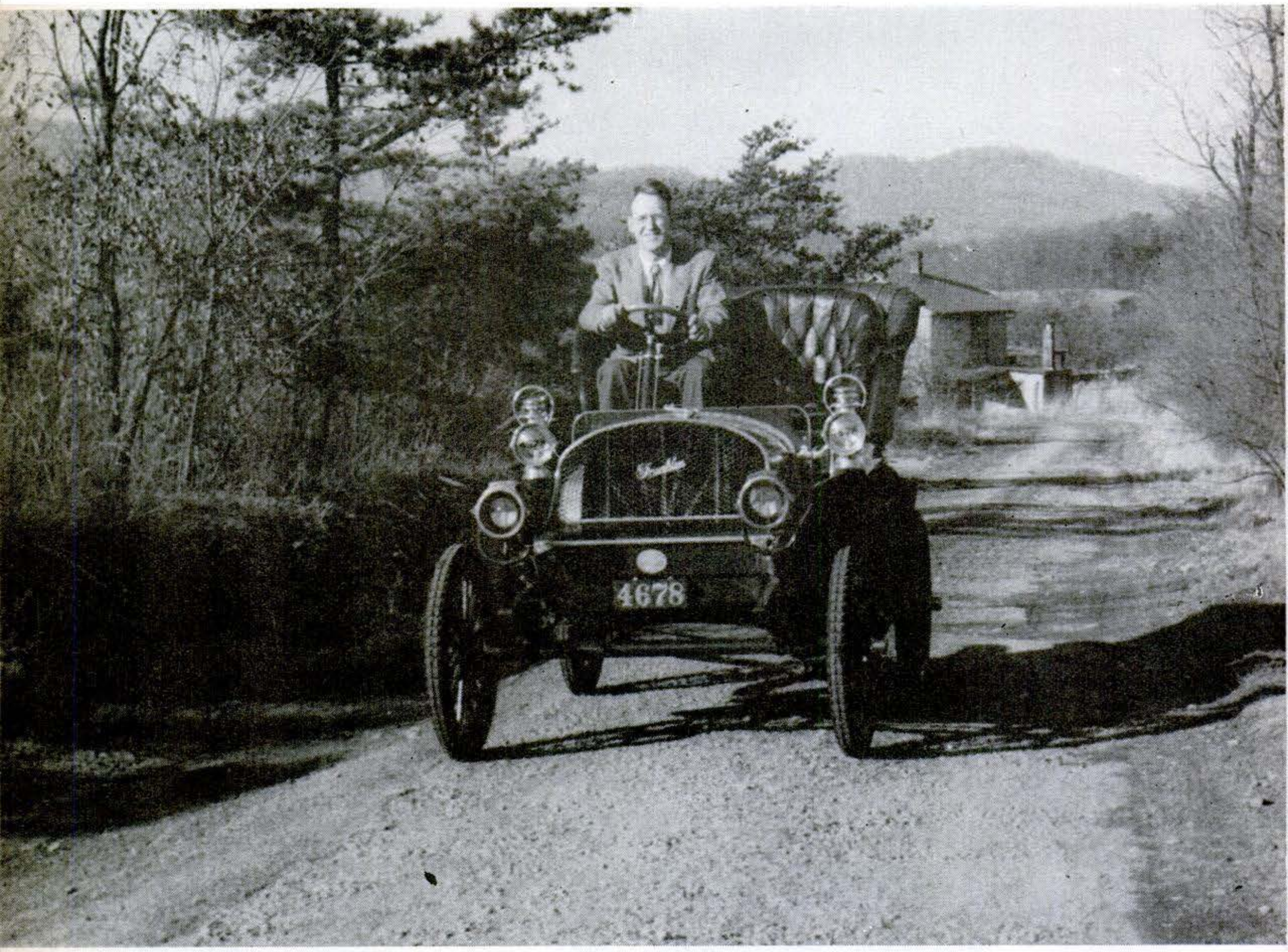
Rebuilding a 1905 Car



By Gardner Soule

MILES S. AMICK, 28, of Cumberland, Md., has been driving around in a 1905 Franklin that took him three years to restore. The car has reached 42 m.p.h., or seven more than the 35 m.p.h. that the four-cylinder, 12-hp. vehicle was expected to deliver when it was new.

Today Amick is adjusting himself to the question that people inevitably ask of an antique-automobile owner. Some will watch the car drive right up to them, and then ask: "Will it run?" Others will inspect Amick's obviously brand-new tires (British Dunlop motorcycle tires, 28 by 3) and ask, "Can you get tires for it?"

Amick is also adjusting himself to the most common remark that casual spectators make about the Franklin: "My, they [the previous owners] took marvelous care of that car, didn't they?" The answer to this comment is in the photograph (at the right) of the car before it was restored. The engine was held in its approximate position by rope. The hood was held on with a piece of baling wire. And the aluminum crankcase had one corner chipped away.

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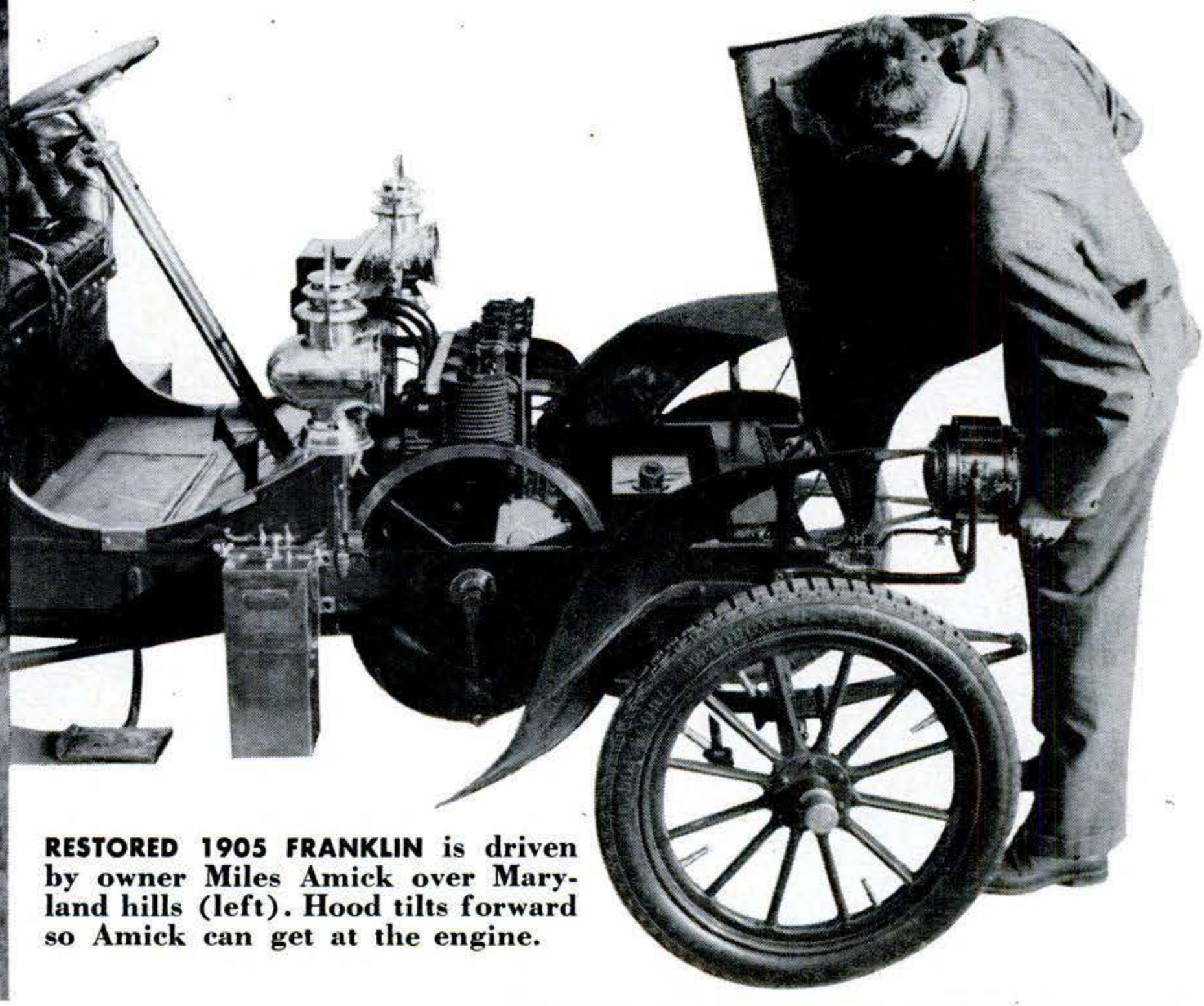
Taught Him 21 Trades

After restoring one tired and battered air-cooled Franklin, Miles Amick had so much knowledge left over . . . that he just naturally started on another.

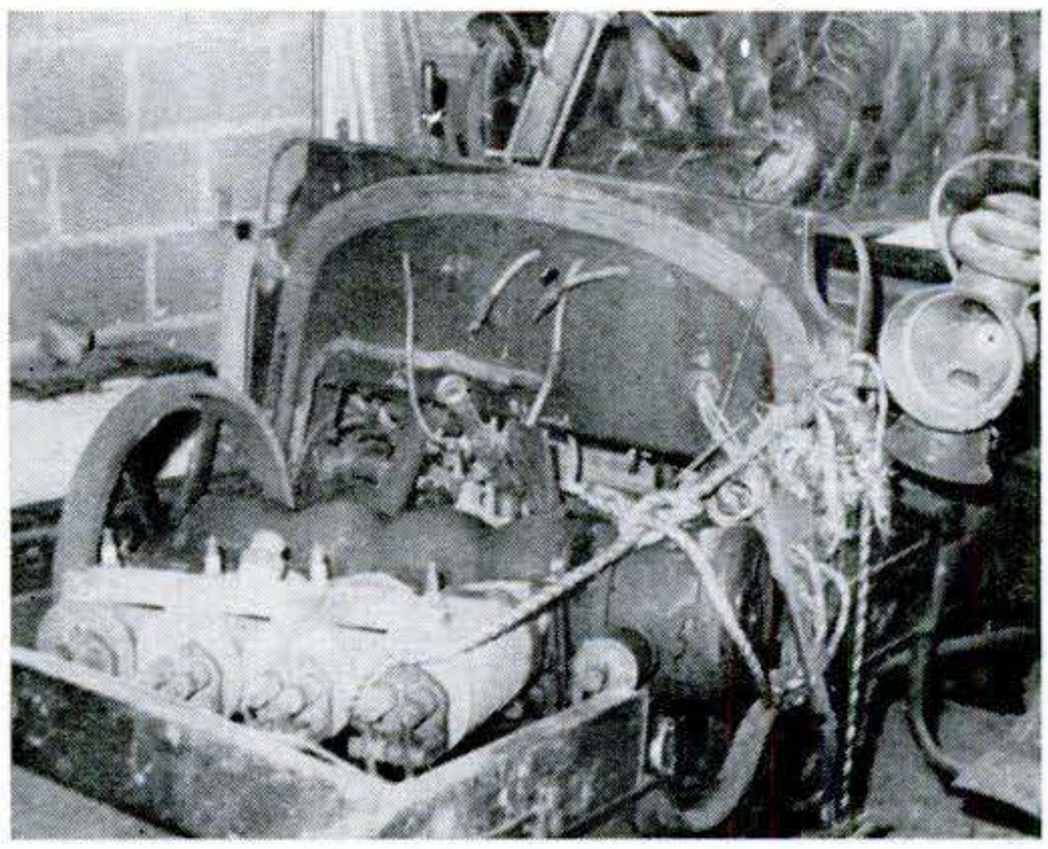


RESTORED 1905 FRANKLIN is driven by owner Miles Amick over Maryland hills (left). Hood tilts forward so Amick can get at the engine.

There were chicken feathers on the car (hens had roosted on it), and cherry seeds in the crankcase (Amick thinks that squirrels dropped them there). Near as he can figure, the car ran for about five years, maybe between 1905 and 1910, then sat in a barn for the next forty.

To all questions and comments, Amick reacts with great calm. "The big thing that the job of restoring the car taught me was patience," he says. "I have learned a lot of that. This is not the game for the chap who has to finish the job before he goes to bed at night."

Amick took six months to find and



WHEN AMICK bought the car, unused for 40 years, the motor had fallen over, was tied in with rope. Four-cylinder engine, called a "cross engine," sits sideways across the car.

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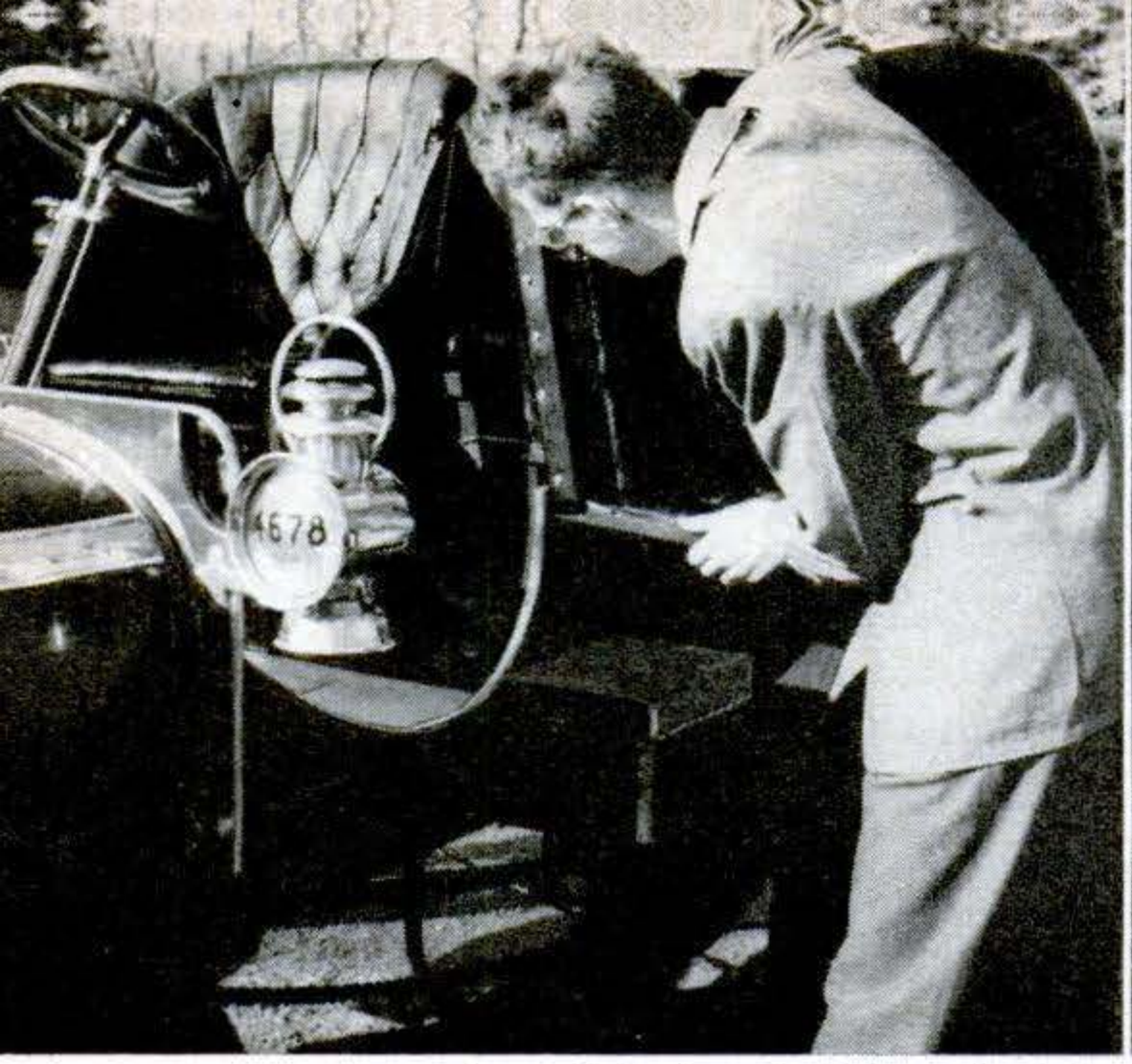
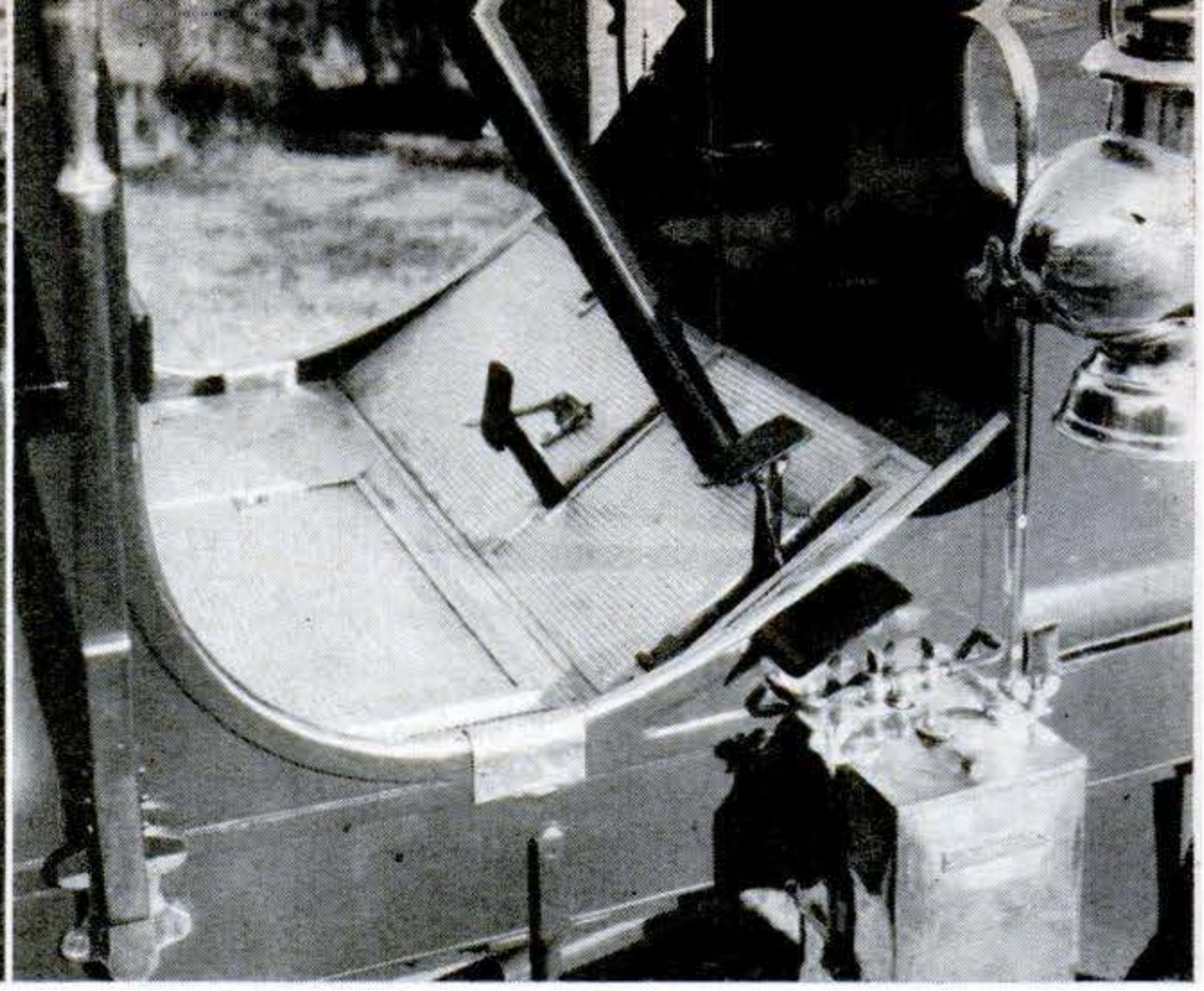


1905 FRANKLIN has right-hand drive. Amick is tilting down the seat on left-hand side, thus opening a path to the high back seat. The leather took weeks of work to restore.



PEDALS, left to right, are the cutout, reverse and brake. The tall outside lever at left is the gearshift: forward for high, back for low. Brass lantern is fueled by kerosene.

horse-trade for the car, back in 1950; had it delivered to him on December 23 that year, got right to work, and finally finished his restoration early in 1954. He can enter the car in this fall's antique-automobile exhibits, including the first one ever to be held for air-cooled cars like Franklins. This show is planned for Syracuse, N. Y., in September, before the Glidden Tour.

Marble Workers Blasted Away

When you restore a car, you cannot simply leave it in a service station for a bit of engine and body work. Over the three years, Amick had to practice, or get other men to practice, 21 different trades. He had to be a carpenter and cabinetmaker to restore the toolbox and the coil box, for instance, and he had to call on marble workers to sandblast away the layers of rust. And that was only the beginning.

Amick thinks it was all worth it. People come from miles around to look at his car, and he gets a compliment or two along with those remarks that test his patience. Besides, Amick is a believer in air-cooled automobiles.

Franklins, which were built in Syracuse, N. Y., from 1902 to 1938, were the only mass-produced American air-cooled cars. But there were others, both U.S. and foreign, including, to name a few, the Frayer-Miller, the Czech Tatra, the Fox, the Detroit Air-Cooled Twin Three, the Victor Page and the Adams-Farwell.

Although the depression finally put Franklin out of business, the argument over whether air-cooling or water-cooling is best has never died down. It is still so lively an issue, in fact, that there exists today an organization, The H. H. Franklin Club, of which Amick is president, devoted to air-cooled cars. In air-cooling, writes T. H. Hubbard in the club's news, "all the multiple attendant failures inherent in [water-cooling] are eliminated, along with considerable weight and over 100 moving parts . . .

"The weather conditions are of no interest to the Franklin engine which was always easy to start, quick to warm up in freezing temperatures and indifferent to extreme heat."

Hottest Car on the Market

Amick himself comments, "The hotter a motor can run, the more efficient it is. Water-cooled motors cannot exceed 212 degrees. Actually, anything above 180 degrees is punishing a motor and should not be done unless absolutely necessary. But Franklins ran anywhere from 350 to 450 degrees, thereby making the Franklin a much more efficient automobile. The lack of water pump, fan belt, etc., also make the chances of mechanical

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failure less than on water-cooled cars."

POPULAR SCIENCE MONTHLY asked Chrysler and Ford engineers why only water-cooled cars are manufactured today in the U.S. and got these replies:

From Chrysler: ". . . a principal reason why air-cooled engines are not used . . . is their objectionable noise level."

From E. S. MacPherson, vice-president, engineering, Ford: "Briefly, I would say that a good, well-designed, water-cooled engine will always outperform a good air-cooled engine from the standpoint of: (1) silence, (2) smoothness, (3) power output, (4) usable spread range, (5) fuel economy, (6) oil economy, (7) power output and torque output per dollar of original cost." Mr. MacPherson admitted that most aviation engines were air-cooled but, he explained, their problems were different.

Taking the opposite side, Carl T. Doman, the last chief engineer for the Franklin company, is quoted in the Franklin club's *Air-Cooled News:*

"I am convinced more than ever that direct air-cooling is the ultimate way by which a power plant should be cooled.

"With the return to V-8 overhead engines, air-cooling becomes a much simpler job. Furthermore, with the advanced production techniques, items which used to appear expensive to us in Syracuse are no longer considered to be expensive."

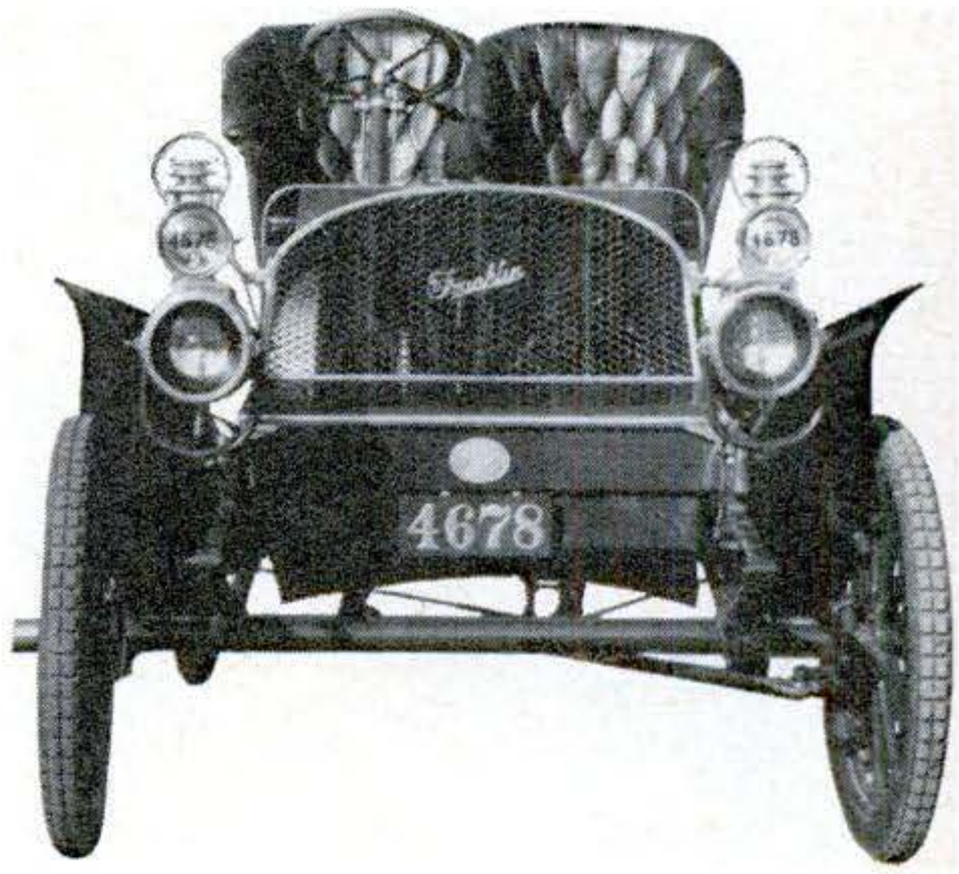
Hundreds of Franklins Still Running

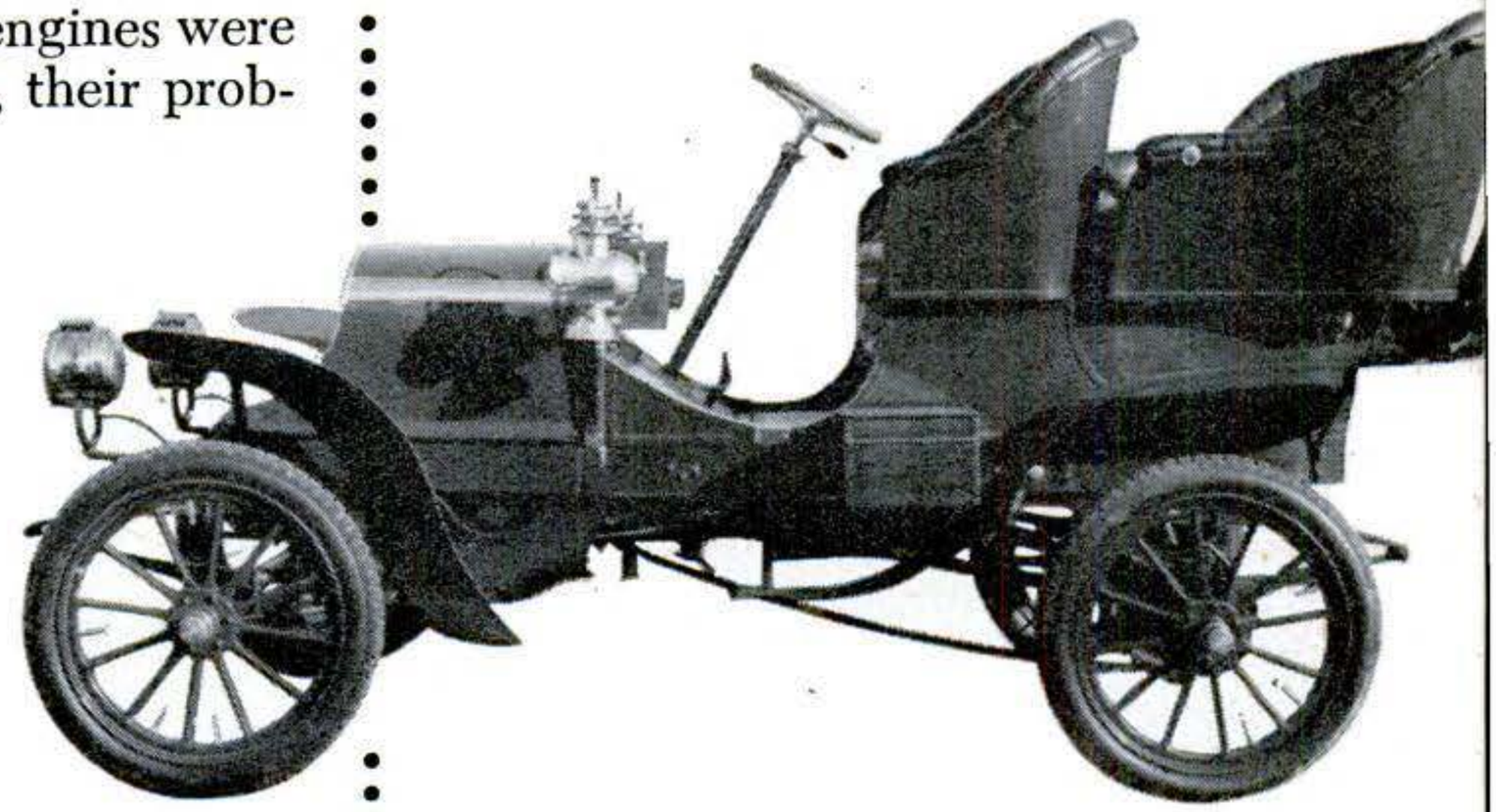
There are, Amick reminds you, a number of air-cooled cars being built in Europe today. And his Franklin club members, who number about 160, know of 500 Franklins still running in the U.S. Amick feels that this "is only a drop in the bucket." One club member has 16.

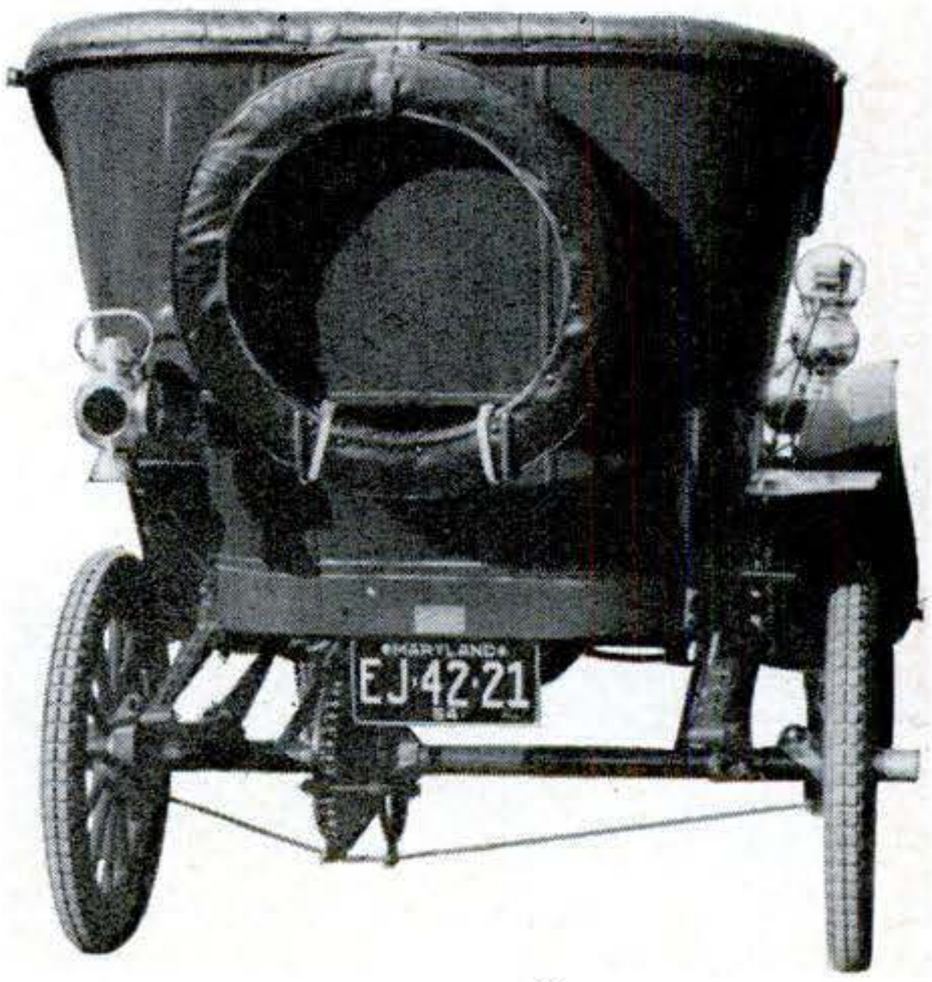
"Quite a few," says Amick, "use their cars every day, but not the real old ones." One man, who has owned nothing but Franklins, drives to work every day

[Continued on page 204]

Here's how you recognize an '05 Franklin







FRONT VIEW shows 1905 license plate (actually not a license but an individual number like a house number), brass grille and head lamps. Side view shows high back seat. Rear view shows chain drive, narrow tires (28 by 3), strapped-on spare.

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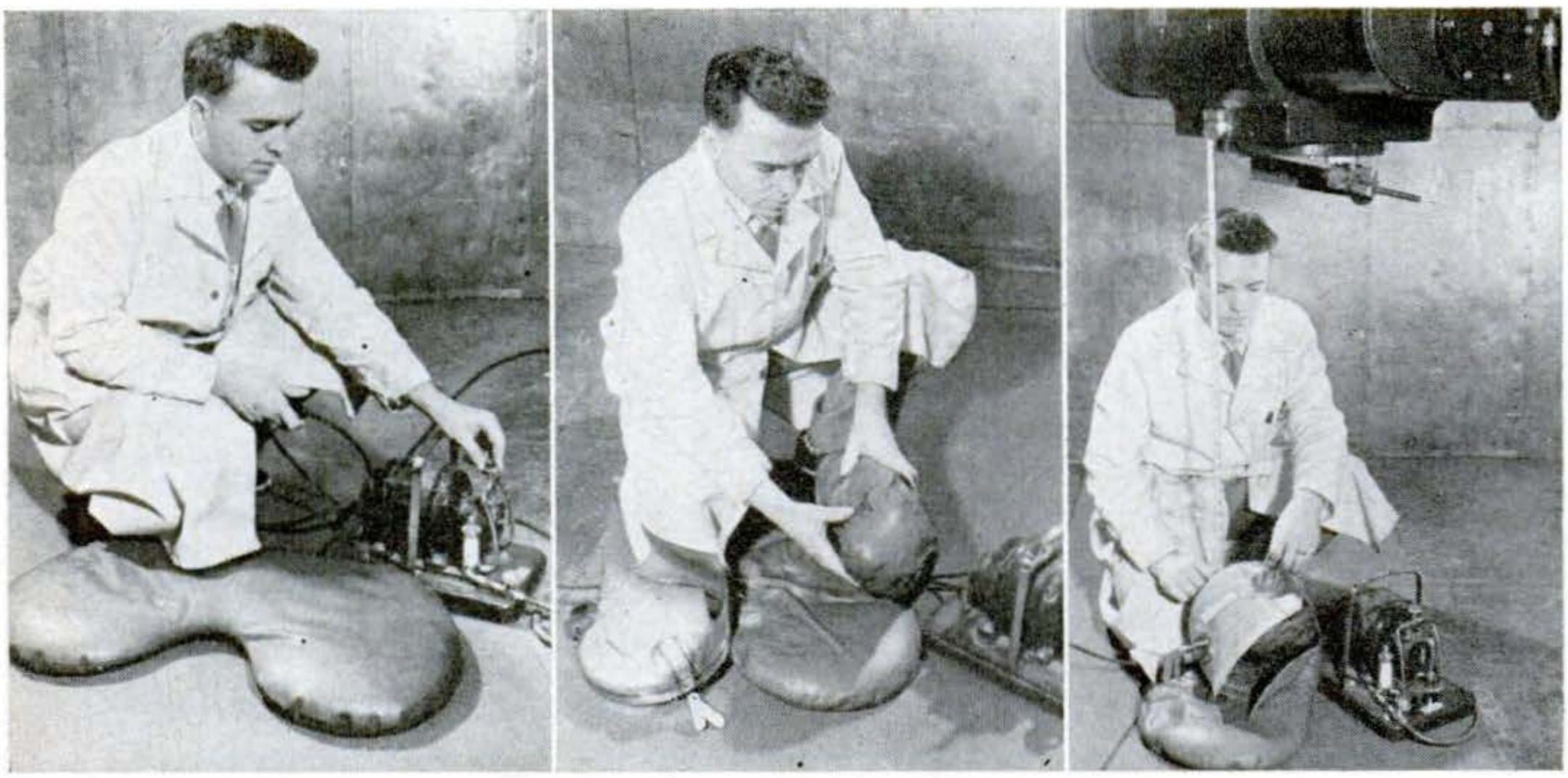
Baby Turbine with Big Muscles to Power Navy Helicopters

A BABY gas turbine for helicopters, now being developed for the Navy, will look like the mock-up in the foreground above. The XT-58 is about the size of the engine in your car, but is six to eight times as powerful. It can be modified to fly fixed-wing planes or boost reciprocating engines. The monster behind it in the photo is the J-47 jet, another GE power package now being used in Air Force interceptors.



Vacuum in a Bag Makes Plane Parts Hold Still for X-Ray Photos

THIN rubber bags filled with granulated plastic, used in hospitals to immobilize patients, have now taken on a factory job. They serve as jigs to speed X-ray inspection of irregularly-shaped jet-engine parts. Partly emptied of air, the kidney-shaped bag (left above) is wrapped like putty around a part (center). When enough air is exhausted to produce a near vacuum, bag becomes rigid and holds the molded shape indefinitely. At right above a part is ready for X-raying at Solar Aircraft's Des Moines plant.

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Everything but a Kitchen Sink Went into This Three-Wheeler

WHEN Bob Dupuis of Lebanon, N. H., rides to school in his Junkmobile, admiring fans surround him. Five old bicycle frames, three bike wheels, a washing-machine motor and a kitchen chair went into the jalopy—plus Yankee know-how and a lot of sweat.

Only His Face Gets Wet

LET it rain—the commuter wearing this wet-weather gear stays dry. The outfit—raincoat, leggings to cover trouser legs, and hat shield—is made by U. S. Rubber, NYC.

Fire Gun Kills Flame with Spray

YOU shoot out fires with the British extinguisher above. It is triggered like a pistol and discharges a fine mist. By blanketing and beating at the flames, the gun is said to put out a 20-foot spread of fire within a second.

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He Rides a Kite

An 86-pound windmill, built of water pipe and wood, puts Igor Bensen in the air, and may hold the answer to cheap sport flying.

By Devon Francis

A TINY, helicopter-like aircraft—probably the world's smallest man-carrying flying machine—is soaring these hot summer days over the sienna-hued hills of North Carolina.

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The machine weighs 86 pounds. Its pilot weighs 210. It flies handily at 25 miles an hour. It will land at seven miles an hour. The thing was built by an engineer-scientist named Igor Bensen. He says that practically anyone could build one. The estimated cost: $100.

Bensen's aircraft is a sort of Whatzit of aviation. It isn't an airplane—its wings revolve. It isn't a true helicopter—no power is applied to its rotor. It isn't an Autogiro—it has no propeller.

In flight it looks like a precocious pinwheel or—to borrow a phrase—an agitated palm tree, dwarf size. Its builder calls it a "Gyro-glider." Anyone watching it fly might settle for "rotary-wing kite."

Bensen's Self-Starter—the Wind

It flies, in fact, much like a kite. In light winds, it is pulled aloft by a cable tied to an automobile. In brisk winds, it can be flown by tethering it to a fence post. Slap the rotor to start it, push on the control handle, and up you go.

"Flying this machine," says Bensen, a licensed pilot, "is the nearest thing to flying like a bird that I've ever experienced. There's no structure around you. There's no noise."

With a 300-foot cable or strong rope, the Gyro-glider can be soared to an altitude of 150 feet, about the height of a 12-story building. But that's tops. Beyond that, the upward pull of the rotor and the downward pull of the tow tend to "buffet" or vibrate the machine and make control difficult.

DESIGNER WEARS STEEL-SHOD SHOES so he can use feet for balance and braking when landing. In free flight, kite will descend slower than a parachute, but it takes practice to master the single control.

On Bensen's testimony, the Gyro-glider is not hard to fly. Fore-and-aft, he says, it's quite stable. Sidewise, it's something else. It takes practice to overcome the inherent skittishness of the machine laterally. There is only one control for flying. On the prototype gyro this is a yoke, a loop of steel tubing. Whether a federal license will be needed to fly the thing has not been decided.

The lifting surfaces are two long, flexible blades, shaped like those of a helicopter and mounted on a single bearing that lets them teeter-totter in rotating. The teeter-tottering, plus manipulation of the control yoke, balance out the lift of the blade advancing into the wind and the lift of the blade retreating from the wind. Without such compensation,

WATER-PIPE VERSION of helicopter kite has standard six-inch ball-bearing wheels in front, roller-skate wheels in rear. Bensen is revising undercarriage to make it a three-wheeler. Small fins give directional stability. Seat cushion was bought at Sears, Roebuck. Machine's height is 64 inches, width 50, length 80. Weight is 86 lb., rotor diameter 20 feet.

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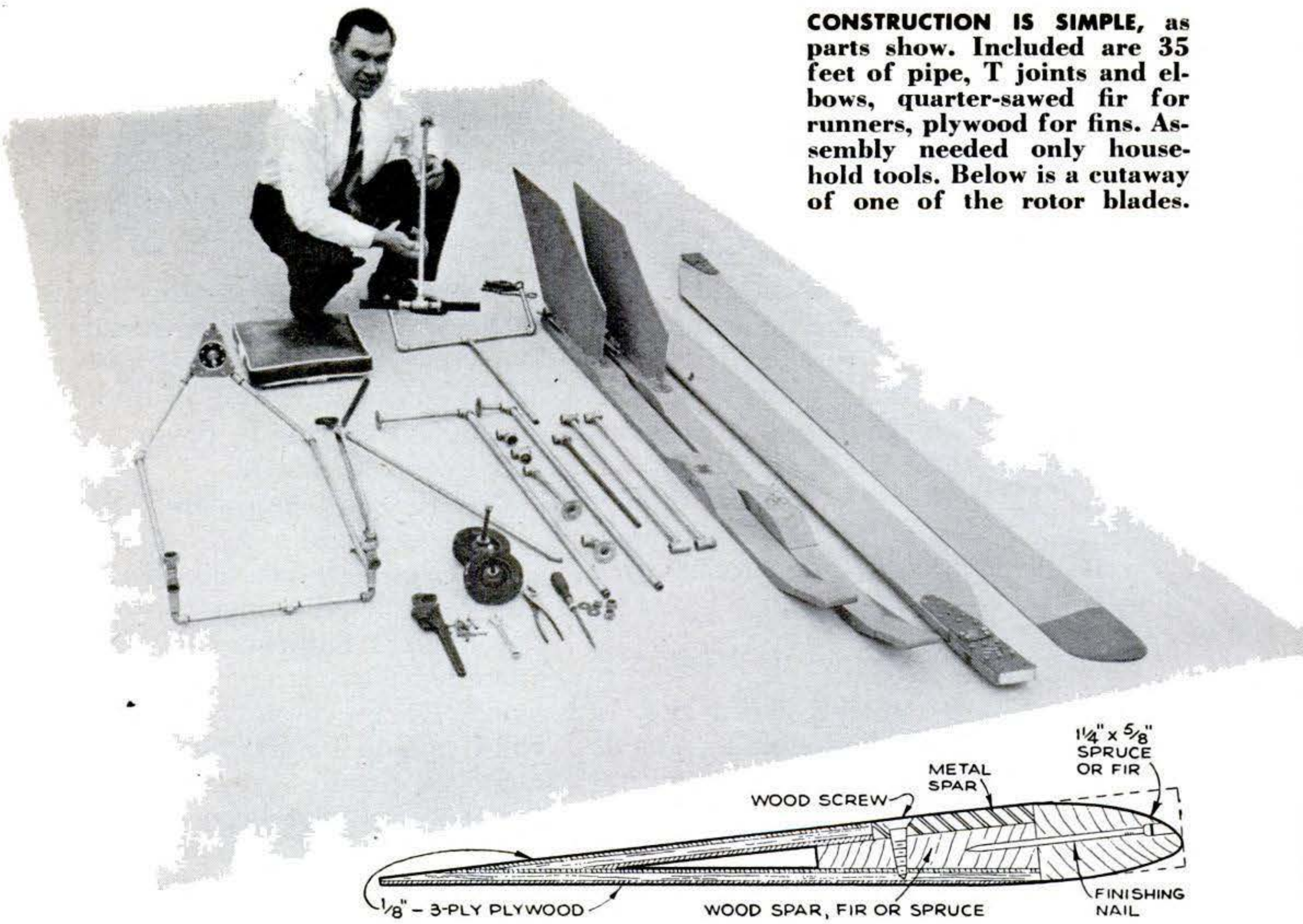

CONSTRUCTION IS SIMPLE, as parts show. Included are 35 feet of pipe, T joints and elbows, quarter-sawed fir for runners, plywood for fins. Assembly needed only household tools. Below is a cutaway of one of the rotor blades.

the machine would tend to capsize—the advancing blade creates more lift.

The rotating blades form a disk, slightly dished, with their tips a bit higher than their roots. Centrifugal force wants to hold them straight. The pendulum-like weight of the "fuselage" and pilot wants to dish them. The result is a compromise.

The plane of the disk's rotation can be changed, and that, in fact, is all there is to the control. Push the yoke forward, and the disk tips backward like a straw hat clapped on the back of the head. That makes the gyro climb. Pull the yoke back, and the disk tips forward. That makes it coast downward.

Gyro Lands Like a Plane

Pushing the yoke sideways upsets the balanced lift of the blades as they sweep through the two side quadrants of the circle they describe around the hub. That causes the machine to move sideways.

To land, the machine is coasted to the ground and, in a light wind, "flared out" like an airplane with the disk tilted back. In a strong wind, the machine is "flown onto" the ground, disk about level, again like an airplane.

Like all blades on rotary-wing aircraft —and like the fixed wings of airplanes, for that matter—that of the gyro is a true airfoil, with a bulbous leading edge, a hump on top and a taper to a knife-edge at the back. The blades lift as they rotate because of Bernoulli's theorem—the air has to speed up to get over the hump. That thins it, and the air beneath the blade pushes up to fill the semivacuum. This upward push is lift.

Wind rotates the blades, as a gust of air will rotate an idle electric fan. The blades can't stop in flight. If the horizontal velocity of the wind doesn't keep them going, its vertical velocity, caused by descent, will.

The real beauty of the Gyro-glider, according to Bensen, is that it takes no precision to build it. The skimpy structure beneath the rotor of his prototype is made of welded steel tubing. But that

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on his second machine, put together to see how inexpensively it could be built, is largely galvanized water pipe. His rotor blades are plywood and solid fir, reinforced with a strip of steel an eighth of an inch thick and two inches wide.

To prove that the blades can be built in a home workshop, Bensen made a pair of them with leading edges of ordinary half-round bought at the nearest lumber-yard. It worked pretty well, but he isn't recommending it. More care devoted to blade shape pays off in increased lift.

"Eye" for U-Boat Wolf Pack

Bensen's acquaintance with aircraft-on-a-string began in World War II when the U. S. Navy liberated some of them from the Germans. U-boat commanders were using them as crow's nests. Paid out on a cable, the rotary-wing kites reported by telephone on the pickings in Allied shipping. This was relayed to the submarine wolf packs. The kites were reeled in, dismantled and stowed below, and the U-boats were ready for business.

"Of course," recounts Bensen, Russian-born but U. S.-educated, "the things were typically German—they had aircraft-type controls, flapping hinges on the rotor, and other complications."

Working at the time for General Electric, Bensen built and flew his first gyro in 1945. It did everything the German version would do, and it was simpler. Bensen went on to more important research jobs for GE and, later, for a Connecticut helicopter company. But he kept the design of the aircraft-on-a-string in the back of his head.

He had a reason. In Hartford he had helped form a model-aircraft club for boys. All the youngsters wanted to fly, but airplanes and gliders were prohibitively expensive. When, finally, he established his own helicopter company in North Carolina, he began designing a tethered rotary-wing machine as a gift to the boys' club.

The gyro is a sideline to Bensen's main business—which is the development of a single-place, military-type helicopter with a novel means of propulsion.

SWIVELING WHEEL on front of welded prototype kite allows steering on ground. Pilot's left hand holds handle to release towing cable. Keel was made from an old ski.

ALUMINUM HUB PLATE secures rotor to shaft. Bearing is floated on a rubber mount to permit tilting for control. Steel-plate portions of assembly were cut from machine-shop scraps.

Yet he takes an open delight in flying the machine and likes to tell about how it cost him money. Before the first flight, his mechanics laid bets on the sly that the thing would never fly. As fast as the money was offered, the engineers covered it. Bensen didn't hear about it until after he had gone up and come down again.

He wishes now that he had known. He had a sure thing. END

In* Popular Science *next month: How to build a flying model of the helicopter kite.

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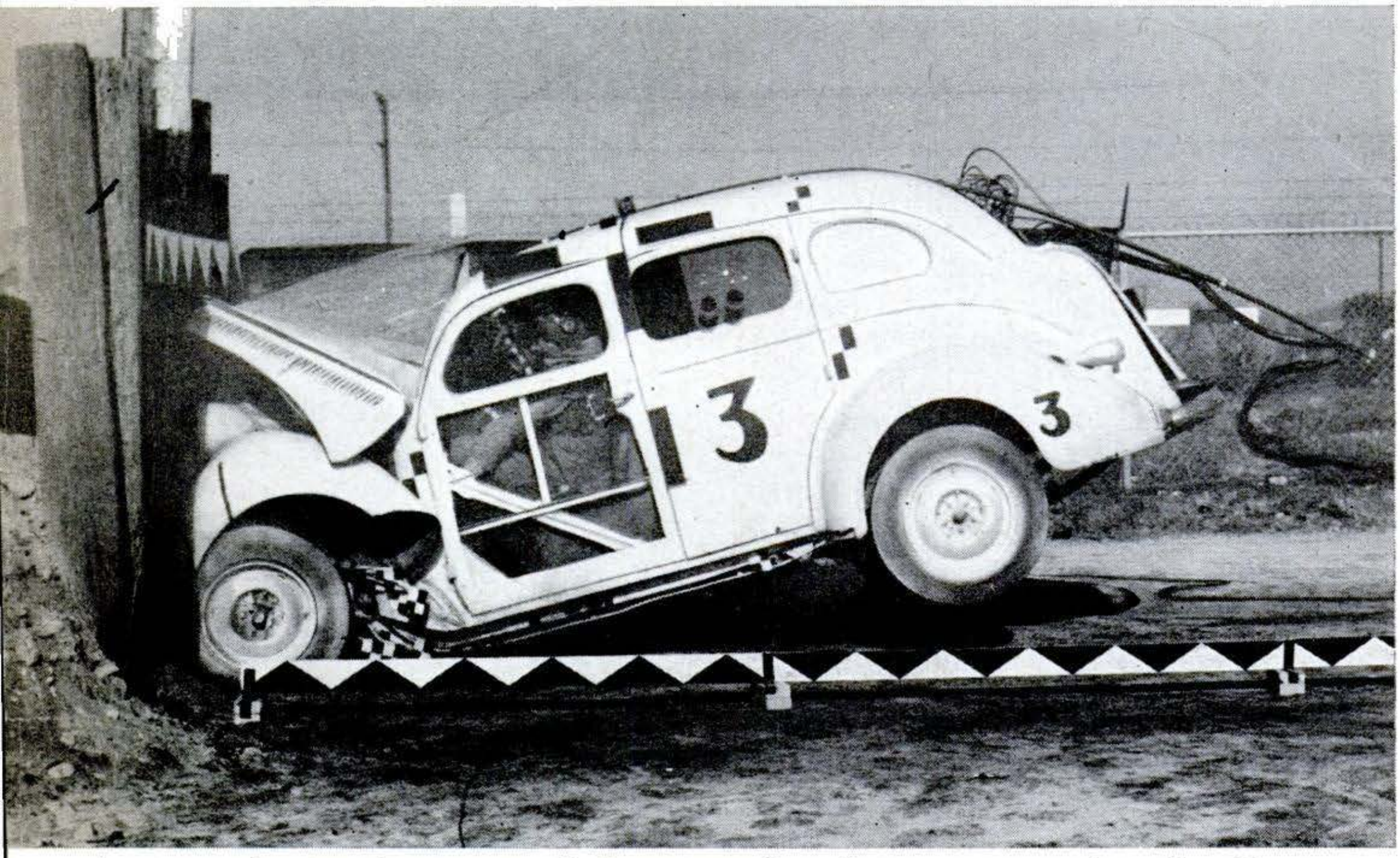
Dummy "Killed" In Smashed-Up Car Could Be You

Test car being towed into position for the crash run.



As car smashes into barrier, signals from recording devices are sent through cable at rear.

One "dies," one is saved by shoulder harness.

A CAR going 25 miles an hour smashed into a solid barrier of telephone poles the other day. The front-seat passenger was killed. His ribs were broken, his neck fractured, his vertebrae driven together. The driver escaped with cracked knees.

Fortunately, the occupants of this car, deliberately cracked up, were dummies. The driver was protected by a new shoulder harness. The passenger rode like most of us, without a restraining belt. A total of 36 measuring devices and a high-speed movie camera told the story of what happened to the dummies and to the car.

This crash research is being carried on by experts at the University of California at Los Angeles to find out how cars might be made safer and the occupants protected.

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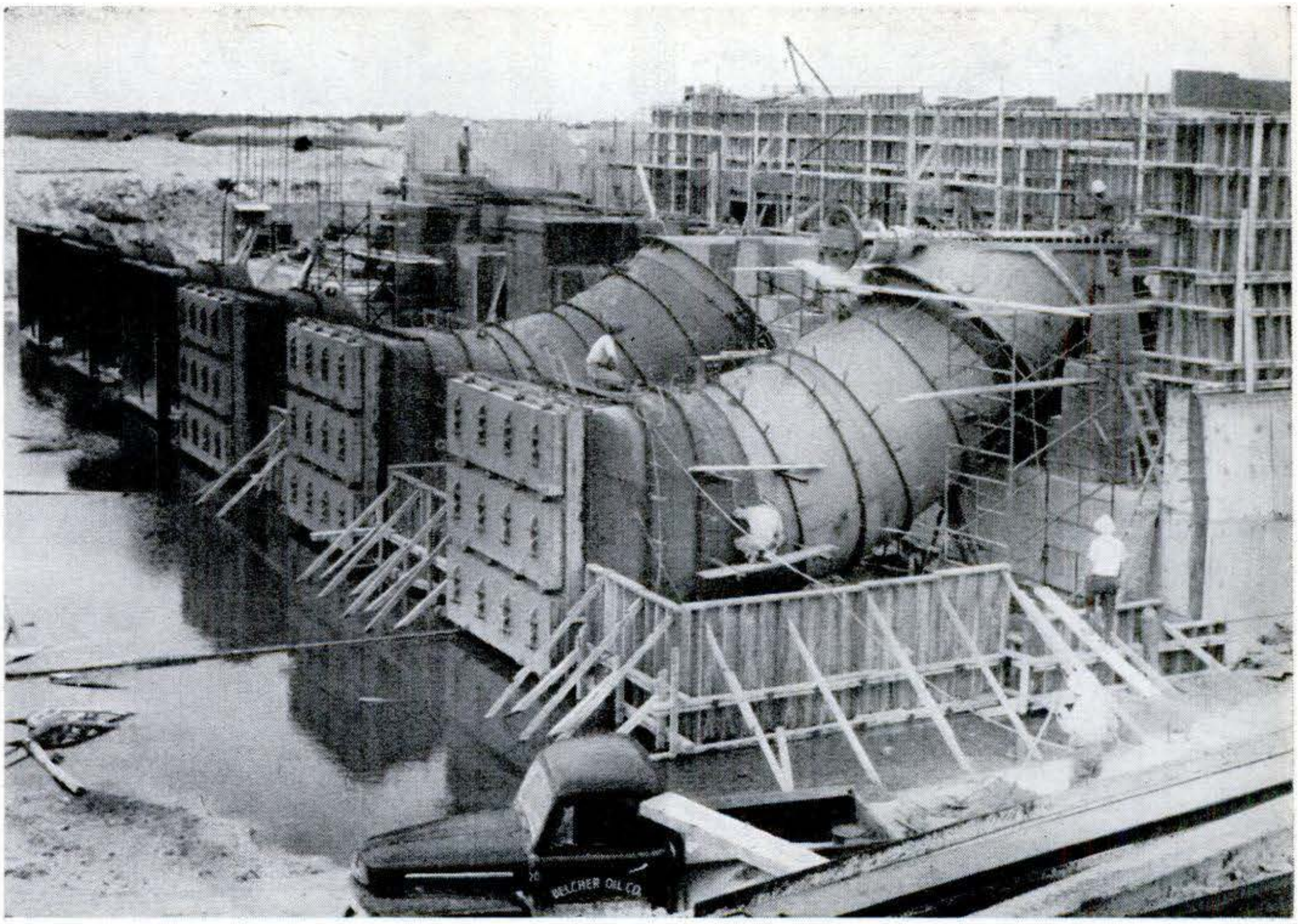
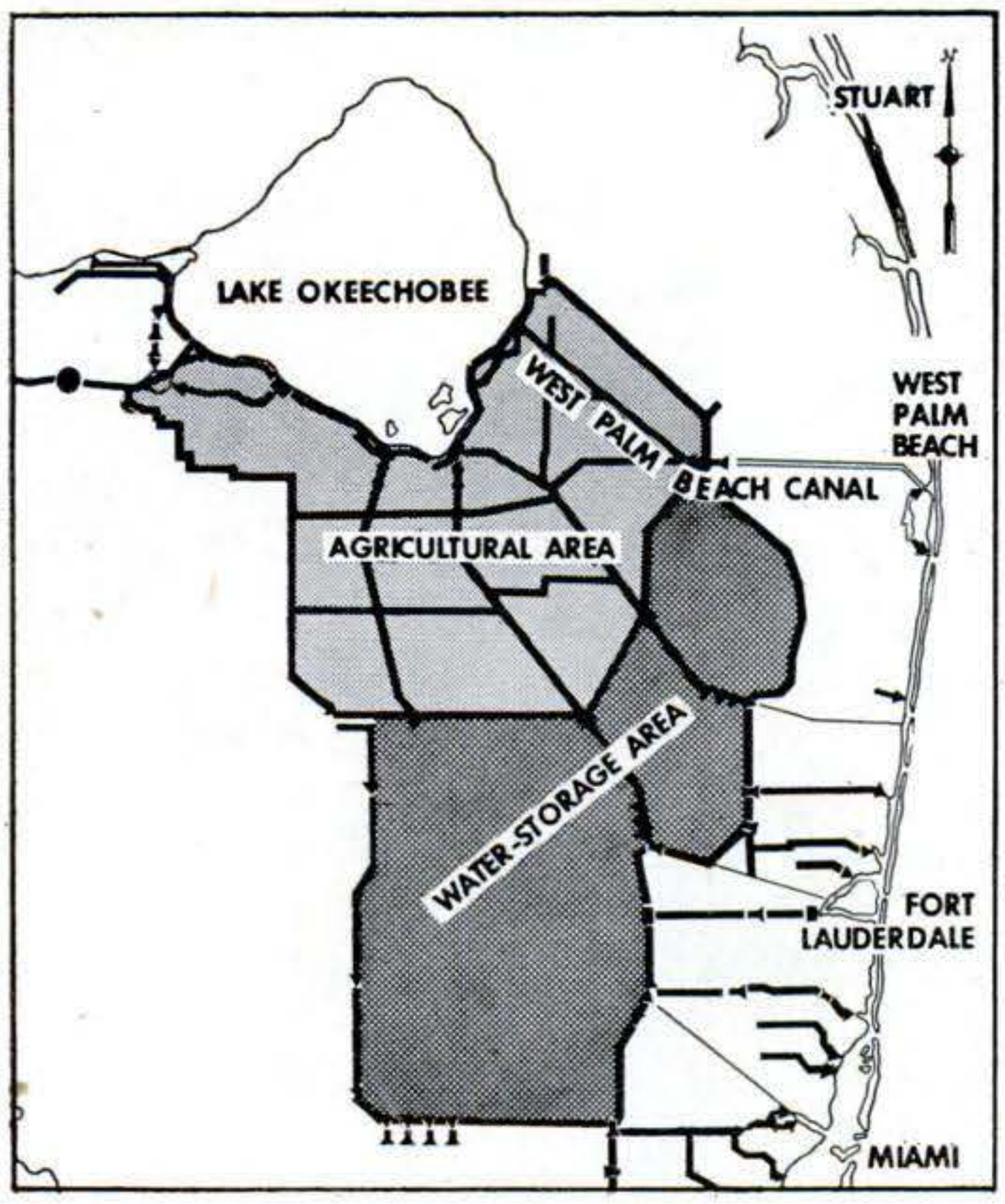


Huge pumps, key to Florida's water-control scheme, have 12-foot-diameter discharge pipes.

Giant Pumps to Harness Floods



FLOOD-CONTROL PROJECT will cover lands shown in light- and dark-shaded areas. Wildlife, such as game fish and waterfowl, will be protected in the huge water-storage basin.

A VAST, rich area of farm and ranch land in Florida's Everglades no longer will be at the mercy of periodic floods or prolonged dry spells when a water-control program, one of the biggest ever undertaken in this country, is completed.

Key installations in the $200,000,000 system will be batteries of giant, diesel-operated pumps. One such unit, shown under construction in the photo above, has a capacity of more than 2,000,000 gallons a minute. It is located on the West Palm Beach Canal, which runs 40 miles from mighty Lake Okeechobee to the Atlantic Ocean.

During rainy weather, excess water is discharged into a huge water-storage area now being enclosed by dikes. In dry spells, floodgates at the pump station will permit water to flow back into the farm lands, via the canal, for irrigation.

Farmers and ranchers control their own water level by means of two-way pumps. When they want to get water off their lands, they pump it into the canal; when water is needed, they pump it out.

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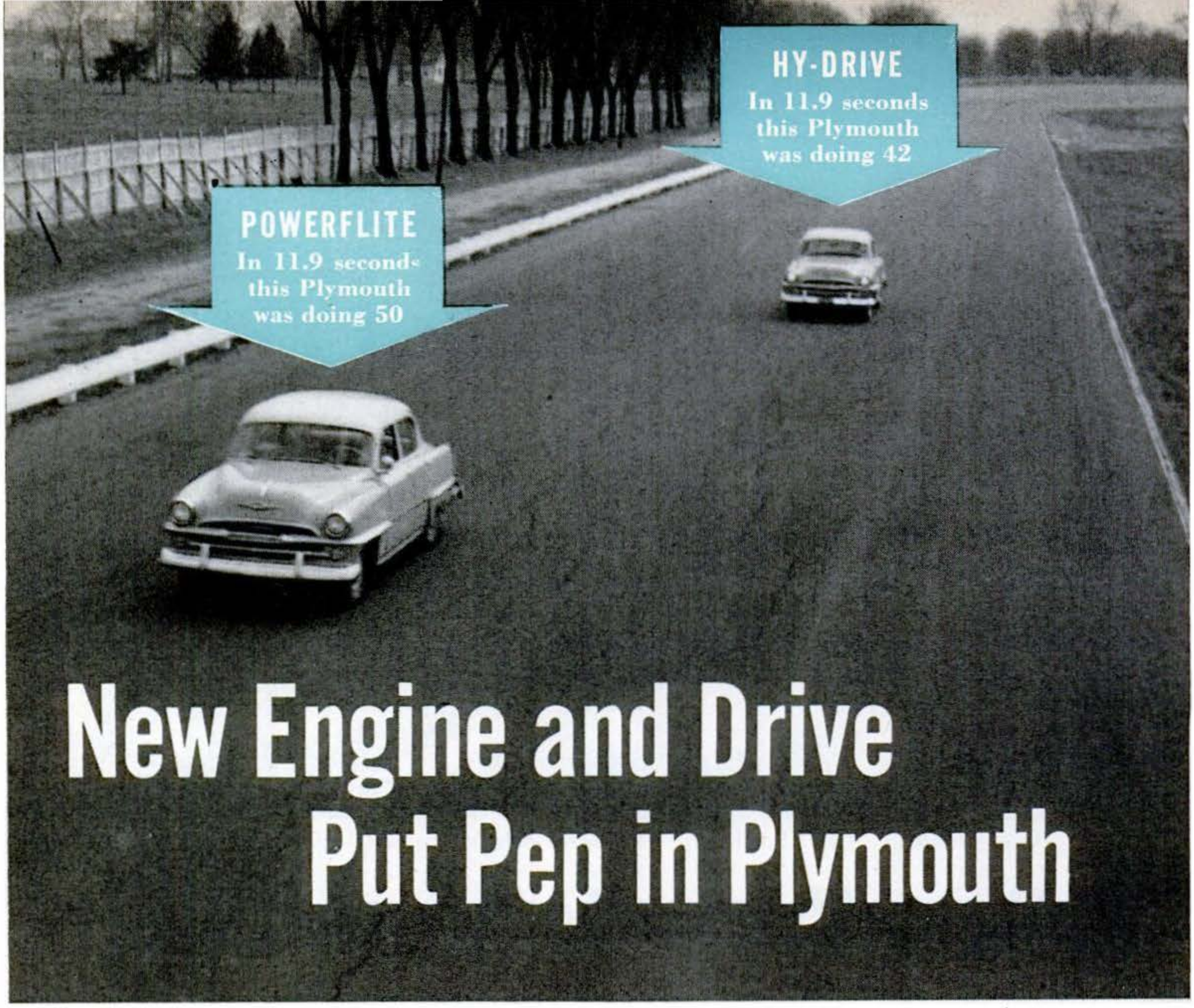
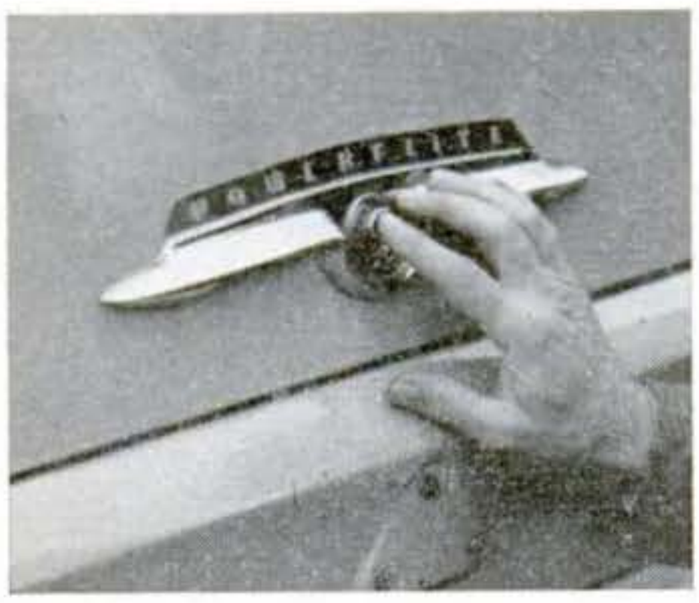


New Engine and Drive Put Pep in Plymouth

These Plymouths took off together on Indianapolis Speedway from the curve at top right.

The lightest automatic drive on the market, PowerFlite is hotter than a pistol and as neatly engineered as a T square.

By Wilbur Shaw



NEW NAME on the trunk lid is the only tipoff that the Plymouth you see parked on the street has a brand-new engine and transmission.

PLOP in the middle of the 1954 automobile year, Plymouth has introduced a car that, mechanically, is almost completely new.

I wondered why. If Plymouth didn't have the most powerful engine in its field, it certainly had one of the most rugged. If a man wanted an automatic transmission, he had one of the simplest in Plymouth's Hy-Drive. And only a hot-rodder looking for an argument could really quarrel with the car's performance.

So I took the new Plymouth out on the Indianapolis Motor Speedway to find out why it had undergone major surgery. I also arranged to have there, for comparison, the '54 car brought out last October.

The new Plymouth has a new transmission. Key to the car's performance, it's the same transmission that serves the rest of the Chrysler Corporation's line—

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the Chrysler, DeSoto and Dodge. It's called PowerFlite (PSM, Sept. '53, p. 116).

Plymouth, born a quarter of a century ago, never had anything but a manual gearbox and clutch until 1953. While everybody else in Detroit was introducing automatic drives with exotic names, Plymouth coasted along with synchromesh. When finally it did change transmissions, it acquired only a semiautomatic.

Now Plymouth has a fully automatic drive, and to borrow a phrase from the beboppers, it's real crazy.

PowerFlite differs from the Hy-Drive transmission introduced in midseason last year in that it abandons the clutch pedal and substitutes a planetary gear system for synchromesh.

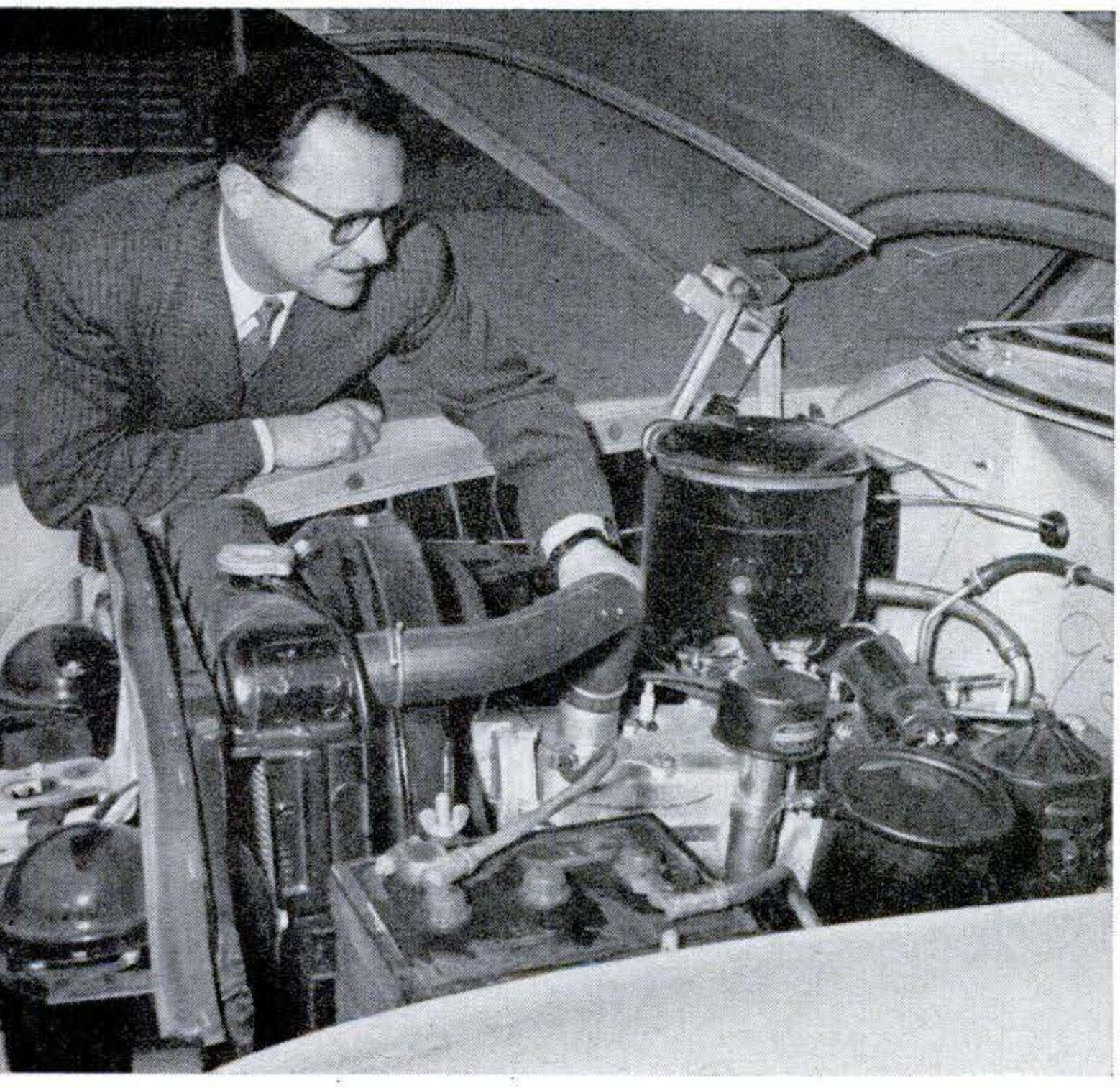
Less Horsepower and Torque, But—

The new engine, up 10 horsepower to 110, is identical in bore and stroke with the Dodge Six. It's considerably shy of the power offered by competitors in Plymouth's field—the Ford has 130, the Chevrolet 125. The Plymouth's torque, the thing that really gives you the push at the rear wheels in taking off or passing, is also less than that of the Ford or Chevrolet.

But just you wait, bub, before you rush to any conclusions. The torque that comes off the end of the crankshaft is one thing. The torque that puts sass in the rear wheels is something else again. In between the two, in automatic transmissions of the torque-

CLUTCH PEDAL has disappeared in lightweight PowerFlite—only 43 pounds heavier than synchromesh transmission, and lightest automatic drive on the market. Torque ratio at stall is 2.6:1; torque multiplication in low gear is 1.72:1. Power steering and power brakes are available.

SELECTOR QUADRANT, unlike that on most cars with automatic drives, has no "park" position. That's because of Plymouth's fine emergency brake. In most cars, the emergency consists of cables attached to shoes on rear wheels. Plymouth's has a drum, and shoes on the drive shaft.



NEW ENGINE is a hardy L-head with a lot more snap than OHV partisans would care to admit. As usual with automatics, it can't be started unless selector lever is in neutral. Oil pressure comes from pumps in the control system, unlike Hy-Drive, which gets oil pressure from the engine system.

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converter type, are two qualifying factors—the converter itself and the mechanical gears that assist it.

The converter multiplies the torque, just as a car jack multiplies your muscular effort so that you can lift a ton with one arm. The point of maximum multiplication is called the "stall ratio." That occurs just at the split second when the car starts moving. The assisting gears also multiply the torque, of course, as does the rear-axle ratio.

Ignoring the axle ratio (which doesn't vary too much among brands of cars), the engineers have coined a term for what causes a motorist to exclaim, "Brother!" when the light turns green. They laconically attribute the sensation to good "breakaway torque." This is the way they calculate it: Engine torque × torque-converter stall ratio × transmission ratio in starting gear.

And this is what I found out about the new Plymouth: the breakaway torque is 849.6 pound-feet, highest in its field. The Chevrolet's is 760, the Ford's 665.5. Part of the Plymouth's showing is due to the efficiency of its torque converter, highest in the industry. Part is due to the gearing combinations chosen by the Plymouth people.

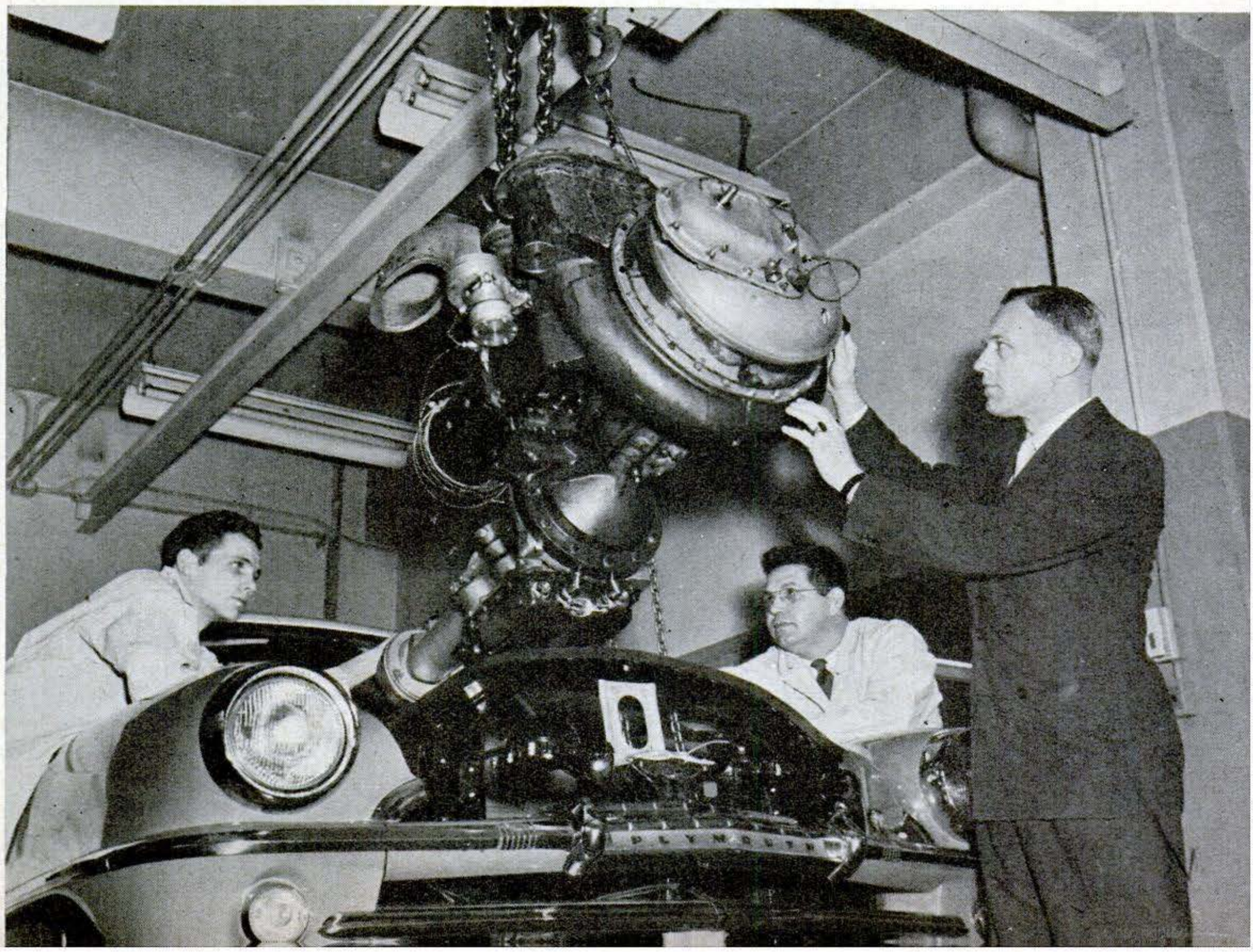
Stop-watched on the Speedway, the new car went from zero to 60 m.p.h. in 18.5 seconds. The car with Hy-Drive required 23.2 seconds.

Accelerating from a steady 40 m.p.h. to 60, to simulate passing on the highway, required only 10 seconds in the new car, and that was without kicking down the transmission into starting gear. The Hy-Drive job was somewhat slower.

Transmission Up-Shifts at 50

Each car had two people aboard and about a third of a tank of gas. For zero to 60 in the new car, I kept the accelerator hard down, and the transmission upshifted from starting gear at an indicated 50 miles an hour. Hy-Drive provides no up-shift. Speedometer error for both cars

Turbo-Plymouth Threatens the Future of Standard



FACTS ON POWERFLITE PLYMOUTH

Model: Belvedere 4-door sedan.

Engine: 6-cyl. L-head; 110 hp. at 3,600 r.p.m.; compression ratio, 7.25:1; piston displacement, 230 cu. in.; piston travel (in feet per car mile at 20 m.p.h.), 2,135; bore and stroke, 3¼" by 4⅝"; crankshaft bearing surface, 37.4 sq. in.; torque, 190 lb.-ft. at 1,600 r.p.m.

Weight: 3,243 lb.; per hp., 29.5 lb.

Transmission: torque converter with planetary train; rear-axle ratio, 3.73:1.

Steering ratio: 19.6:1 (with power), 21:1 (manual); radius of turning circle, 19½'.

Effective brake-lining area: 158 sq. in.

Springs: front, coil; rear, semi-elliptic.

Outside dimensions: height (loaded), 61¾"; over-all length with bumpers and guards, 193½"; width, 74¼"; wheelbase, 114"; overhang, front 32", rear 47½"; tread, front 55⅞", rear 58½".

Inside dimensions: seat-cushion width, front 59¾", rear 58¾"; leg room, front 43¾", rear 43⅜"; headroom, front 36⅝", rear 35⅛"; seat height, front 14⅜", rear 15"; vertical distance, steering wheel to seat cushion with seat in mid-position, 5½"; front-seat adjustment, horizontal 5", vertical 5".

Tire size: 6.70 by 15.

was about one mile an hour at 40 and three miles at 60, on the high side.

In contrast to the new transmission, where the gears assist the torque converter, Hy-Drive doesn't get a gear assist unless the motorist actually shifts gears. With a gearbox incorporating a regular Low, Second and High, Hy-Drive will continue to be offered—at least for now—as a cheaper, alternative transmission.

PowerFlite not only is Detroit's most efficient transmission—I would venture the opinion that it is also just about the smoothest. END

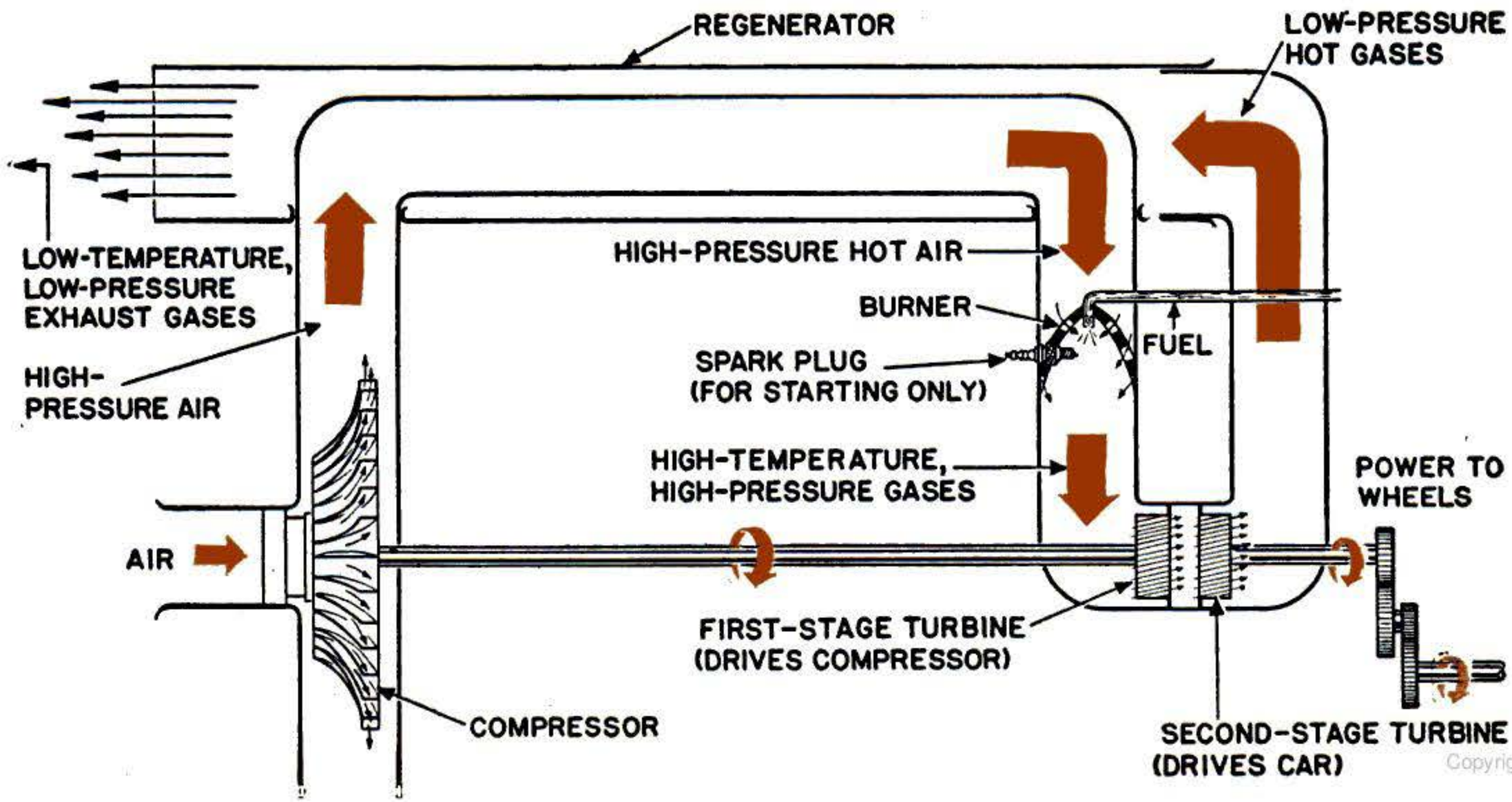
Next month Wilbur Shaw writes about the plastic-bodied Kaiser Darrin.

Piston Power Plants

MAJOR obstacles to using gas turbines in passenger cars have been high fuel appetite and high tailpipe temperature. In the new Chrysler gas turbine, an experimental job installed in a 1954 Plymouth (left), both problems have apparently been controlled by a "regenerator." This is a device that extracts heat from exhaust gases and uses it to boost combustion efficiency (see sketch below).

Compared to the piston engine it replaces, the experimental power plant is smaller, 200 pounds lighter, and has only a fifth as many moving parts.

Rated at 120 shaft horsepower, the turbine "digs out" its test Plymouth at accelerations equivalent to those delivered by a 160-hp. piston engine.



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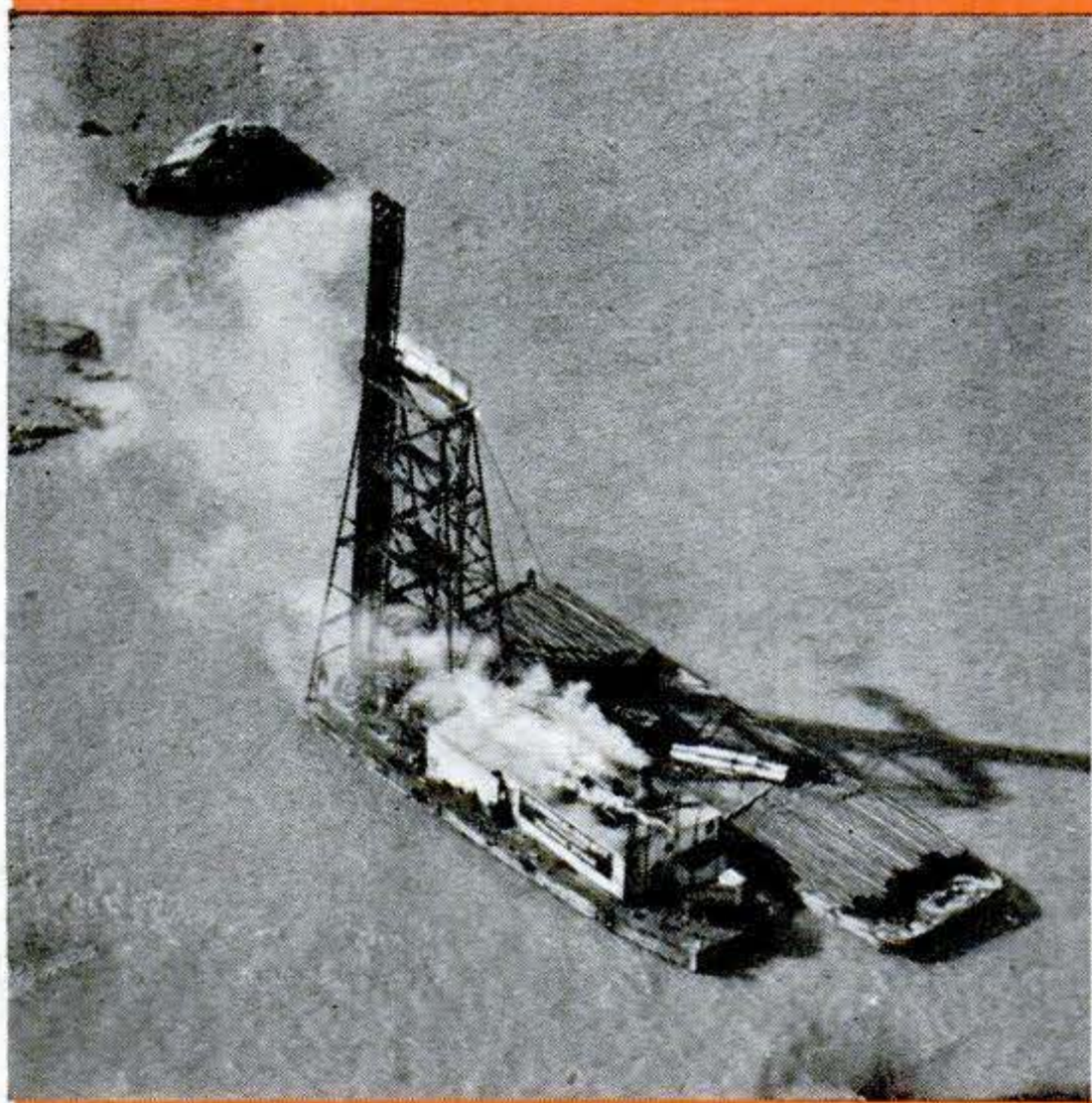
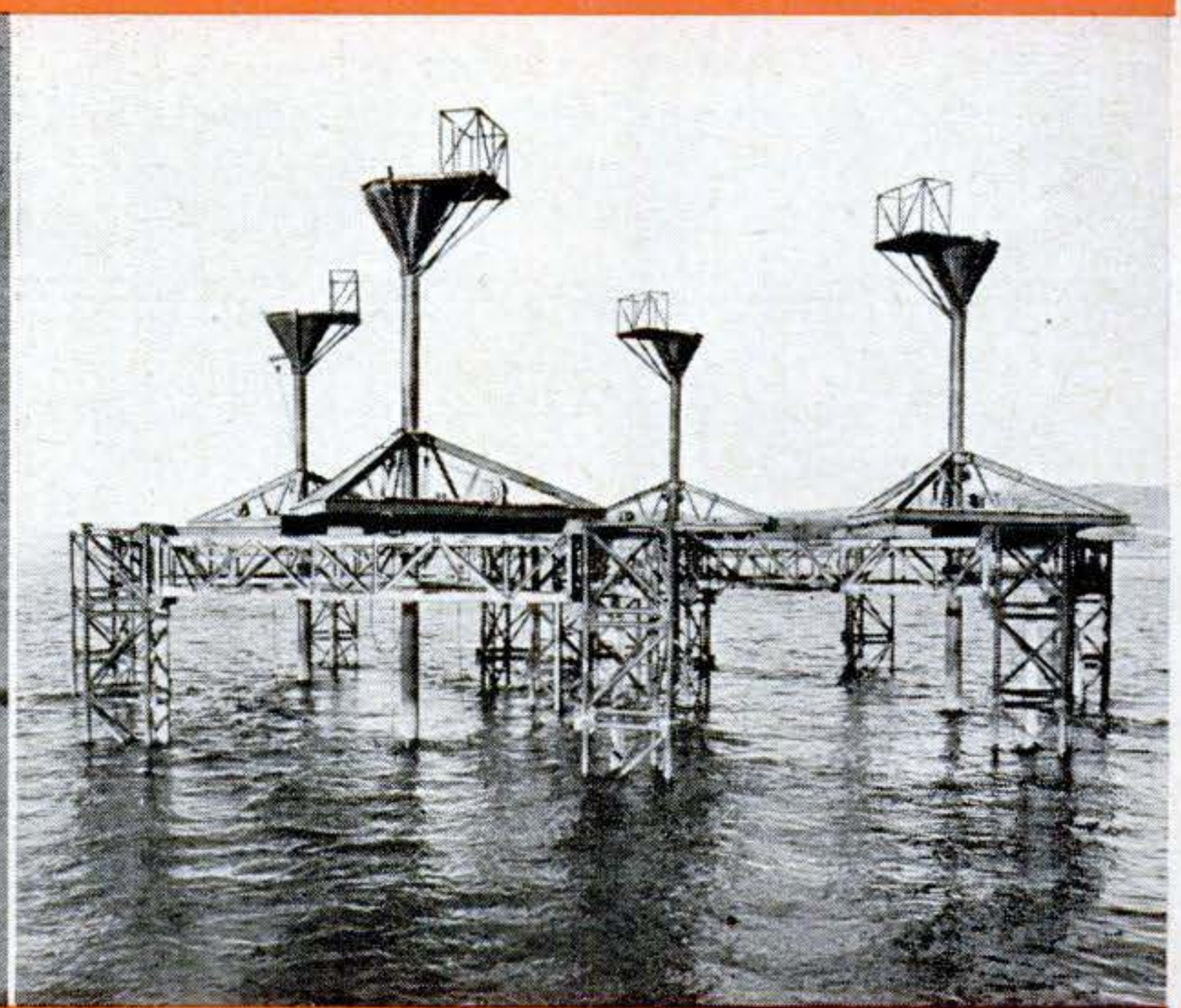
Two-Story Bridge to Crack a Bottleneck

New San Francisco Bay span will carry four times as many



HUGE PILE DRIVER is leaving a trail across San Francisco Bay. Its powerful battering ram sets 125-foot-long H-beam steel piles that will support the new bridge.



THOSE QUEER-LOOKING CONES are not surplus crow's nests with radar antennas; they are giant steel funnels used for channeling concrete into underwater pier forms.

THE San Francisco Bay region is outgrowing its britches, so the California Department of Public Works has decided to put a steel gusset in them.

This gusset is in the form of a $62,000,000, twin-deck cantilever bridge, more than five miles long, that will connect the rapidly growing Bay Area cities of Richmond and San Rafael.

Four miles of the new span will be over water. At its highest point, it will be 185 feet above the water. The entire span and its approaches will not have a grade exceeding three percent—a boon to truck traffic.

In the middle, arching over the main and secondary navigation channels of San Francisco Bay, will be two cantilever spans, each 1,070 feet long.

The bridge will have two decks, one above the other. Each deck will have three 12-foot concrete roadways. Traffic will move in only one direction on each deck.

Ferries have plied the route of the projected bridge since 1915. In late years the ferries have carried a peak load of 1,000,000 vehicles annually. It is estimated that the new bridge will carry about 4,000,000 vehicles during its first year, 1957. Ten years after that, it is believed there will be an annual flow of some 6,000,000 trucks and cars across the span.

Although special facilities are being built into the bridge to simplify maintenance, it is estimated that operation and upkeep will cost $500,000 a year.

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cars as ferry boats do now.

A FLOATING PLANT mixes concrete. It is fed with cement and gravel that a crane picks up from barges alongside. At right is an aerial view of Richmond end of bridge.

Japan's "Flying Feather" Drifts into Baby Convertible Field

THIS midget two-cylinder, rear-engined Japanese convertible, called Flying Feather, has a top speed of only 37 miles an hour but it travels about 58 miles on a gallon of gasoline. It weighs 880 pounds and costs $1,000, far less than other popular-priced Japanese automobiles. The new car is 109 inches long and 51 inches wide.

Scientists Go Overboard, Meet Fish on Own Level

EQUIPPED with diving lungs, glass-front helmets and foot fins, California marine biologists are dropping in on surf fish, abalone, rockfish and, unintentionally, an occasional shark these days in a state-backed effort to learn more about the local seafood.

The diving scientists, shown at their watery work in the photos at right, have probed as deep as 100 feet and stayed below for a half hour at a time. One of them (far right) recently brought back a nine-pound lobster that he had hauled out of a sunken reef.

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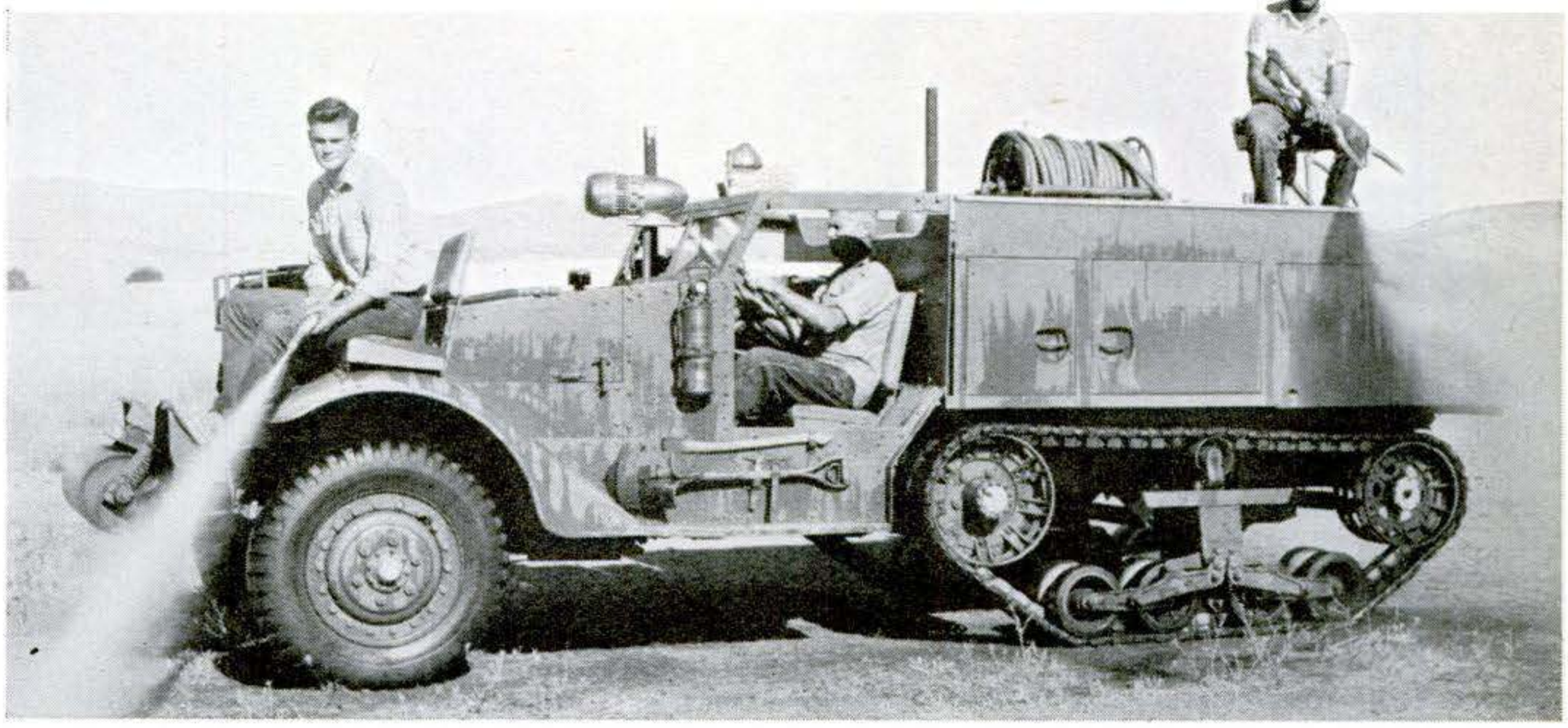
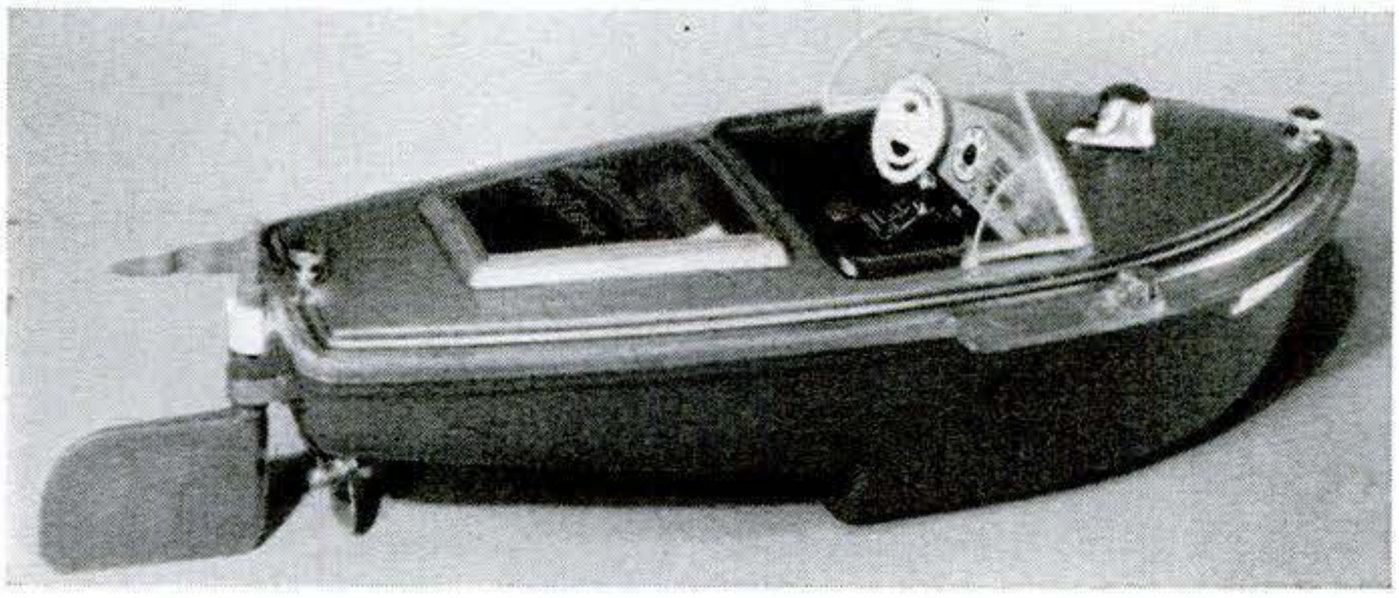


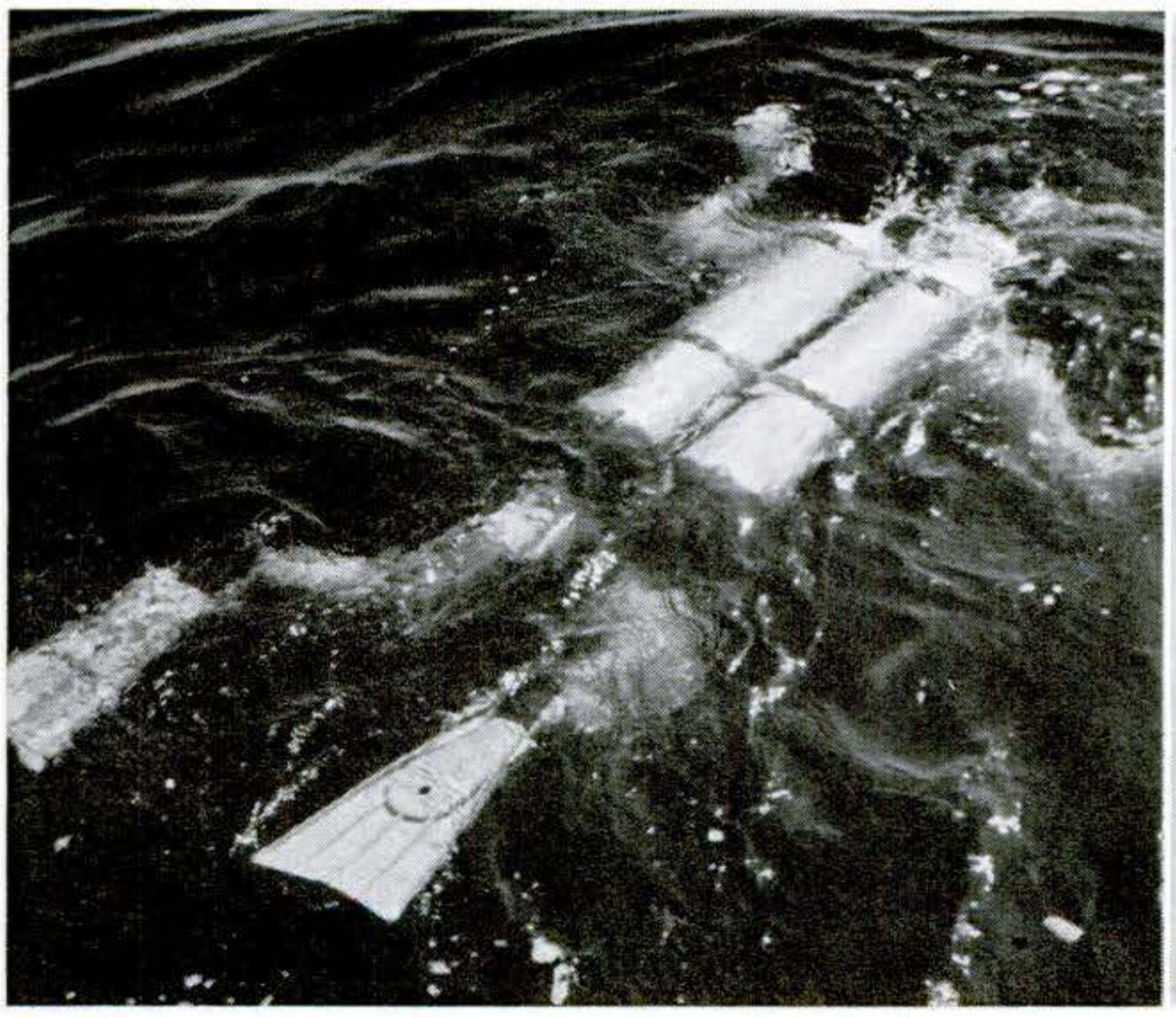
Homemade Half-Track Fire Truck Easily Takes Hills in Stride

To FIGHT grain, grass and brush fires on his hilly ranch near Willows, Calif., Lester Lederer converted an Army half-track into a fire truck that can go anywhere. It carries a 500-gallon water supply and three hoses, along with a 30-horsepower pump.



Toy Boat Cruises by Remote Control

YOUNG skippers can pilot the Schuco toy electric boat at left over a 30-foot course. Two flashlight batteries power the craft through a control box with buttons for forward and reverse motion.



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This gracious 150-unit motel at Baton Rouge is adding 50 units and a 500-place restaurant.

Swimming pools are common at motels out West, where they have special social significance.

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The amazing growth of

Horizontal Hotels

Once crude cabins, motels now often resemble mansions, and far outnumber vertical hotels.

By Kenneth Wylie

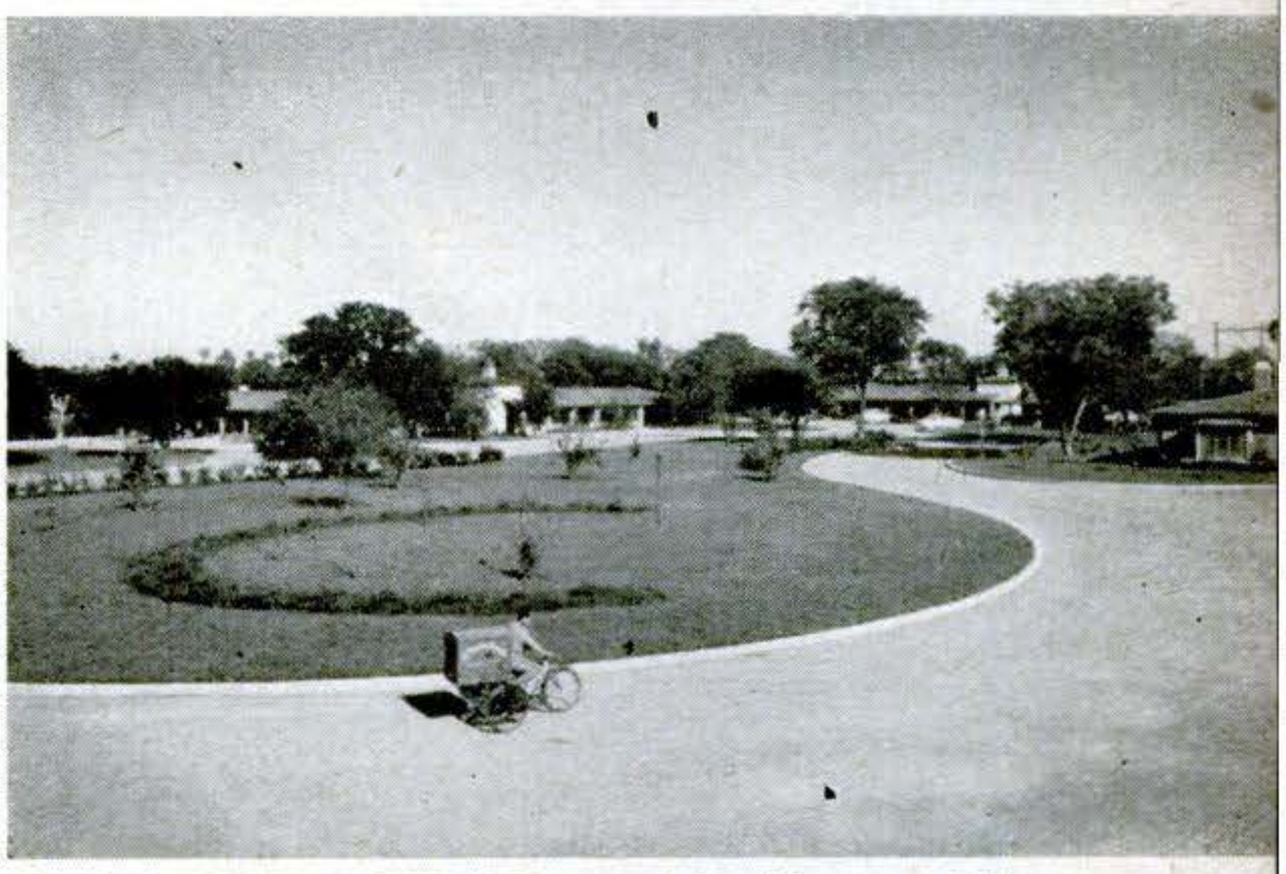
MORE than 50,000 motels await you now, if you take your vacation by car. In the 1930s, curbside cabins generally offered you sagging beds and cast-off quilts, tissue-thin walls, uncertain plumbing and the choking warmth of wood stoves. Today's descendants of those dreary havens are often as fancy as any big city's tallest, plushiest hotel.

And they are still going up at a dizzying rate in all parts of the U.S., Canada and Mexico. More than 3,000 new ones were built in this country alone last year, at a cost of $420,000,000. That's more than six times as much money as was spent to build the spectacular world headquarters of the United Nations in New York.

Latest Facility: A Landing Field

There are now twice as many motels as hotels in the U.S., and no wonder. Americans spent $20,000,000,000 on their vacations last year, the AAA reports—twice as much money as General Motors, the world's biggest industrial corporation, took in—and a huge hunk of that sum was distributed along the highways. The vacationists took 86 percent of all their trips by car. They paid more than $1,500,000,000 for motel facilities, which ranged from a helicopter landing field (the Western Hills, Fort Worth, Tex.) to free ice cubes (almost everywhere). By the year's end, the nation's motels had

A $100,000 EXTRA at a $2,000,000 motel-hotel in Texas is a 190-by-150-foot landing field for helicopters, presumably not rare vehicles for fabulous Texas businessmen.



SPEEDY ROOM SERVICE at this Brownsville, Tex., motel, laid out like a swank development of ranch homes, is provided by a three-wheel delivery cart, pedaled to your door.

ON A FLORIDA BEACH lies the 115-acre motel village below, which features 650 housekeeping units, nearly any sports facility you can think of, and a good-sized shopping center.

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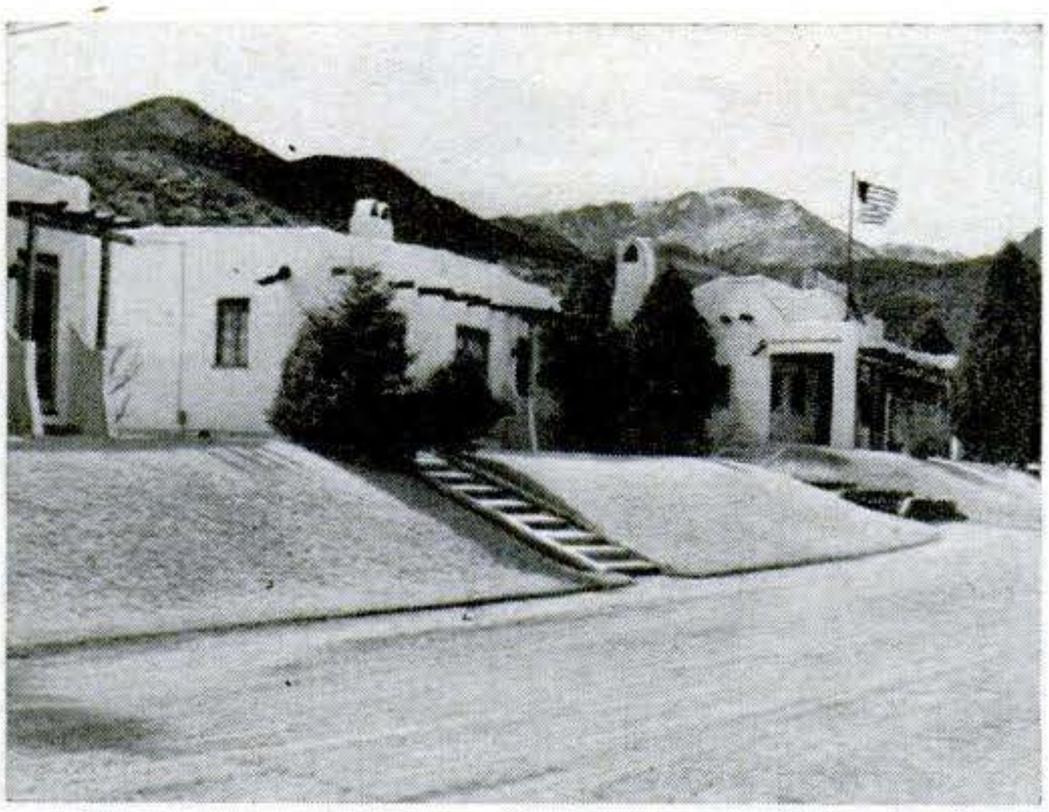
FEW HOTELS could outdo the luxury, comfort and style evident everywhere in the plush lounge of this big, new Miami Beach motel, member of a topflight U.S. motel chain.

SUITABLE FOR PALM BEACH, where it stands, the motel whose curving dining room is seen above has separate pools for adults and kids, tennis courts, a bar, and small cars for hire.



A FIREPLACE IN EVERY ROOM is an alluring feature of this motel in Manitou Springs, Colo., at the foot of Pike's Peak, visible beyond the flag. Some units have living rooms.

totted up 45,000,000 registrations—a number equal to nearly one-third of the entire population.

To attract this cash-laden horde of automobile travelers, the horizontal hotels beside the road have been growing steadily bigger and more elaborate.

Suppose, for example, that you were to pull up at nightfall before the entrance to the $2,000,000 Terrace Motor Hotel in Austin, Tex. You and your brood would be escorted—not by the owner, as in the old days, but by a bellhop—to one of 211 bedroom-bath units, cascading down a high, wooded hill. Your home for the night would provide air-conditioned comfort, ice water, excellent beds, attractive furniture and decorations, ample space for luggage and clothes, a roomy bathroom with plenty of man-size towels and lots of hot water, and quiet.

The kids could work out the day's kinks in and around the motel's swimming pool. Once the bags were unpacked, you and your wife could lounge on the shadowed lawns. If any pressing or cleaning needed doing, the valet or laundry would take care of it.

A call to room service would summon the mixings for a refresher before dinner, and once that was downed you and the family could stroll to the cheery coffee shop for a tasty evening meal.

Even Breakfast in Bed

Want more? Well, if you'll leaf through the AAA Motel Guide (about 6,000 listings) or Duncan Hines' list of the motels he approves of (around 3,000 listings), you'll probably find some motels that serve their guests a free breakfast in bed, between six and eight a.m.

The proprietor of a Georgia motel, hunting for a specialty that might lure more travelers to his door than the next, figured out that it would cost him only eight cents a day per head to give his guests their first meal of the day on the house. Eight cents covered the cost of two doughnuts, a glass of orange juice and a big cup of coffee, with cream and sugar. A child's breakfast would cost

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This Grand Rapids Motel Was Built for Half the Average Cost

By using flat roofs, slab floors, prefabricated steel casement windows and a new kind of brick that forms a wall in one course, Louis Cordogan, Chicago architect, built the new, 20-unit Jim Williams Motel at Grand Rapids, Mich., for only $3,400 a unit. The U.S. average cost per motel unit is $6,825.

The choice of flat roofs with center drains eliminated the need for gutters, downspouts and the double construction that a pitched roof demands.

SCR bricks (named for the Structural Clay Products Research Institute), used for the outside walls, come in six-by-12-inch blocks. They are jamb-slotted at one end to receive metal window frames. Walls of these bricks cost about the same as frame construction.

The contractor had to excavate only six inches of Grand Rapids soil to reach sand. On this natural fill he spread a 68-pound composition vapor barrier, then poured four-inch slabs of concrete. The architect beat the cold-floor problem by running a perimeter of rock wool around the inner foundation walls.

Each building, placed diagonally on the lot, consists of four units clustered around a utility-room core. Every unit is roughly 15 feet by 10½ feet.

The Jim Williams Motel typifies two growing trends in the industry. It features separate buildings in place of a string of attached rooms, and its manager and his wife trained for their jobs by taking a three-month correspondence course in motel management, including 20 lessons in college-level accounting.

him 10 cents, for he would have to substitute milk or hot chocolate for coffee. Even so, he estimated that he could serve a free breakfast to every person in his 30 units every day of the year for less than one percent of his annual operating cost.

If your holiday journeyings take you through the Southwest, you will find that many a motel rivals a dude ranch both in looks and in facilities.

Along the seacoasts, it is not unusual to come upon a motel like the El Rancho, a 50-unit layout at Myrtle Beach, S. C., which sprawls within a few steps of the Atlantic. In addition to surf bathing, it offers hunting, fishing and golfing.

If you are driving through the Midwest, you will discover many motels—like Eaton's, in Hamilton, Ohio—boasting swimming pools. Eaton's pool is typical. It is heated, measures 20 by 40 feet, has underwater lighting and is surrounded by a patio.

However, at a minimum cost of from $3,000 to $5,000, it will be some time before motel swimming pools are as common as their sterilized glasses.

Motelmen like to say, and can hardly refrain from rubbing their hands when they say it, that every road leads sooner or later to a motel. This is especially true of California, where there are 7,330 motels, and Florida, which has 4,124. These favorite vacation states lead all the others in motel population, though it is surprising how concentrated they sometimes are elsewhere. For instance, there is an 11-mile stretch just south of Hartford, Conn., that contains 31 motels.

Why Travelers Like Motels

Your reasons for preferring a motel to a hotel have been pretty well established—at least in the minds of the folks in the motel industry.

At the end of an eight- or 10-hour drive in vacation-time traffic, you haven't the heart to push on through city congestion to a hotel. You want to stop right beside the road and step straight from your car into a cool room with inner-springs, ice water and silence. You want to let the children loose to romp in the open space that surrounds most motels.

[*Continued on page 208*]

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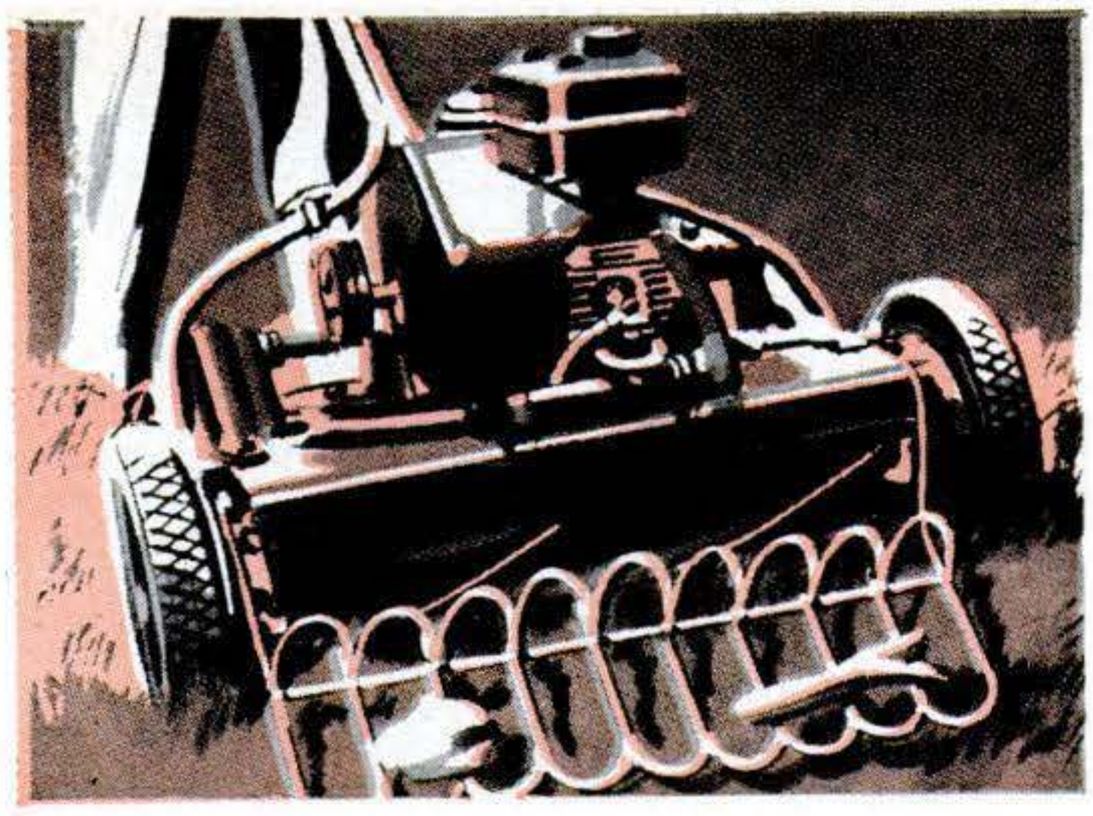
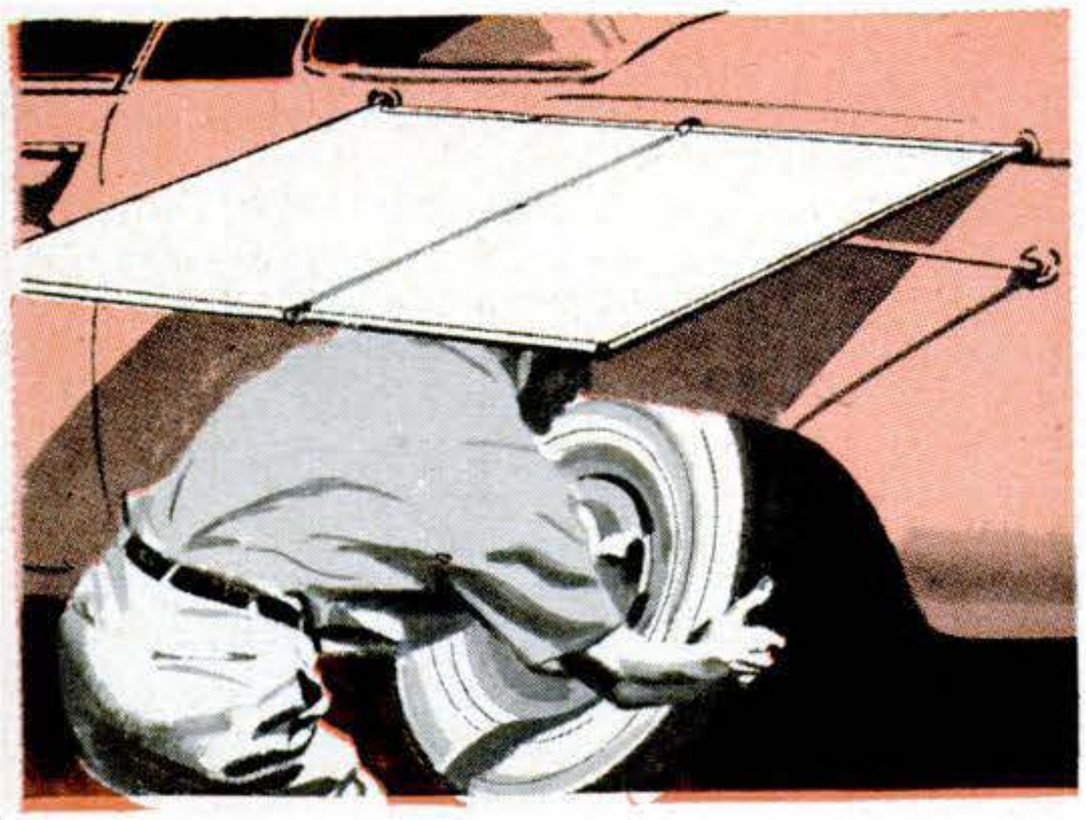
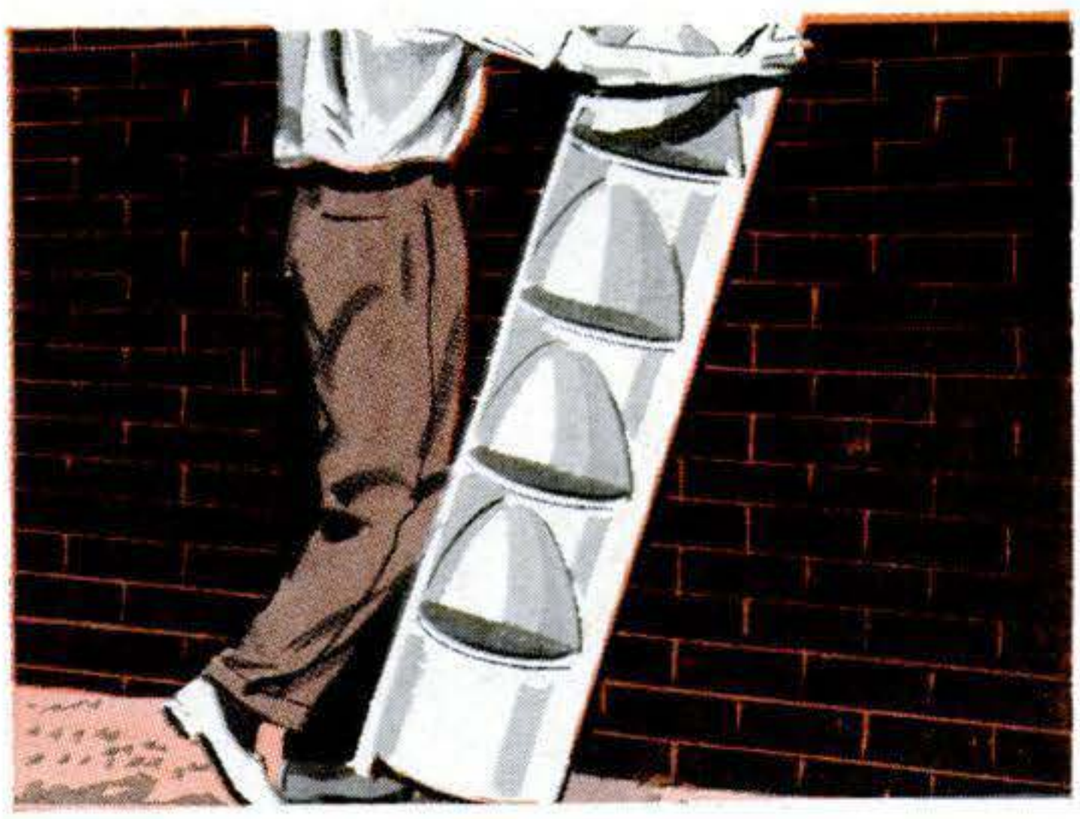
I'd Like to see them make...



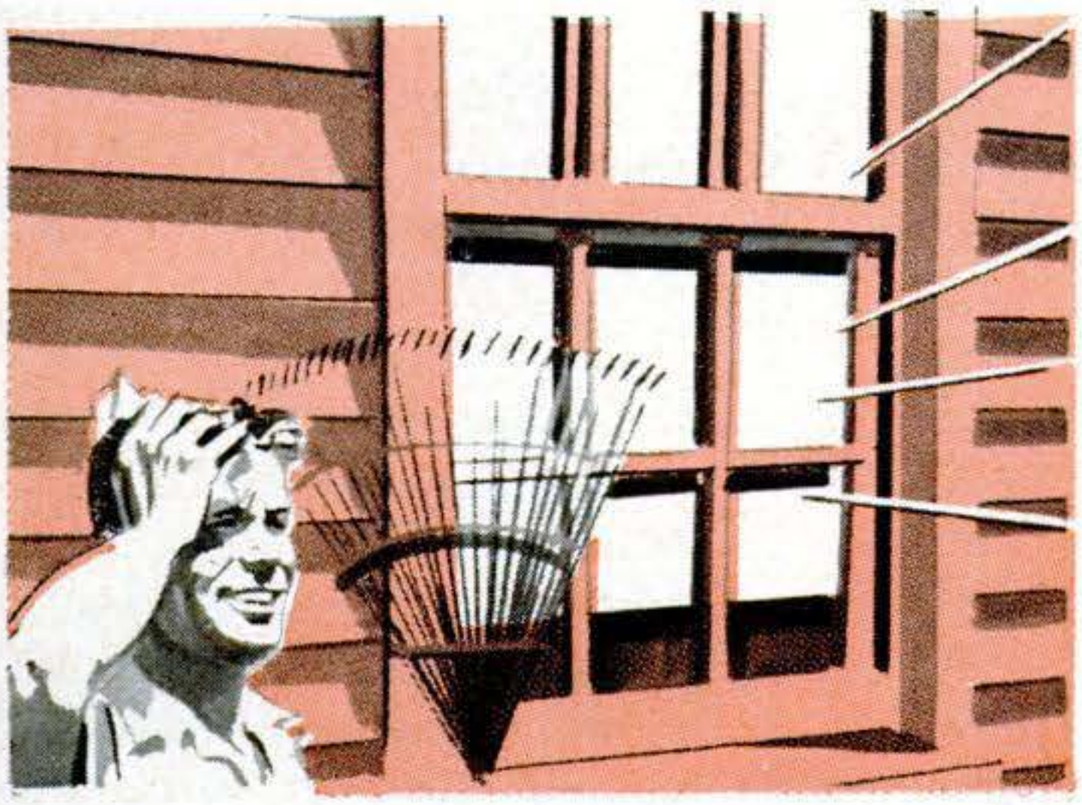
LAWN MOWERS with a rake attachment at the front to push twigs and stones out of the path of the cutting blades.—*Mrs. Karl S. Dewey, Malone, N. Y.*



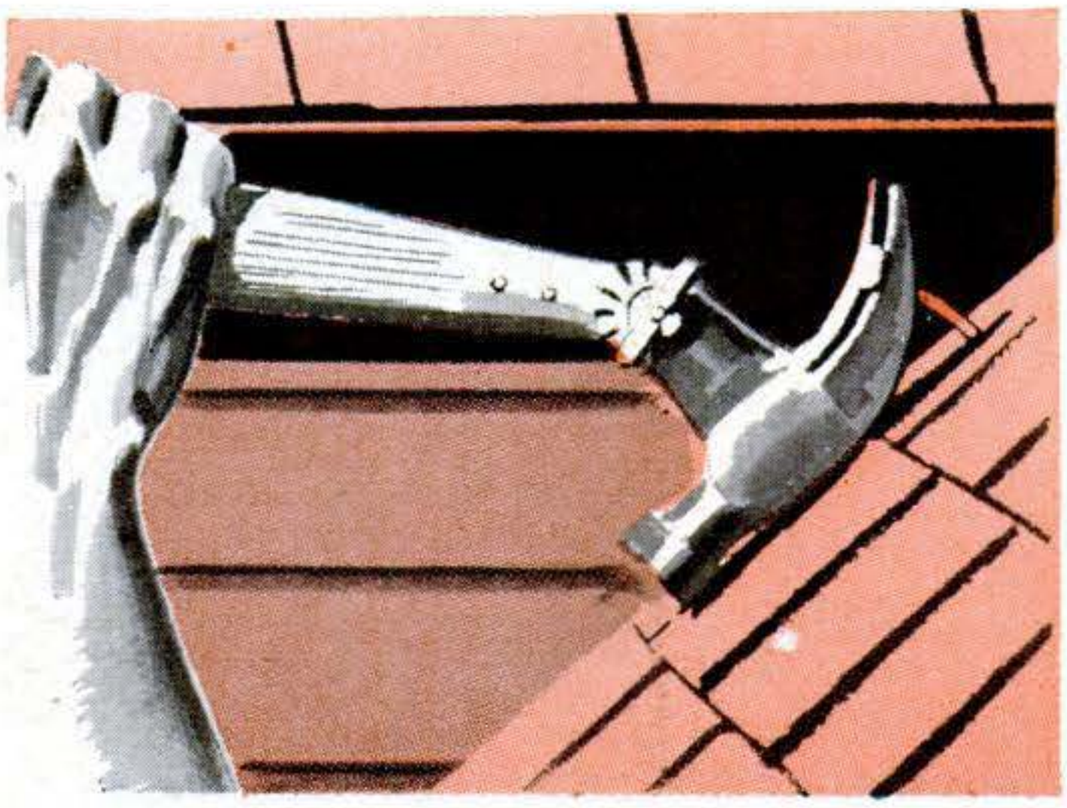
A COLLAPSIBLE SHELTER that would clamp to the fender of a car when you have to change a flat tire in bad weather or in the hot sun.—*J. D. Ducharme, Holyoke, Mass.*



A LIGHTWEIGHT LADDER made from sheet aluminum with treads welded in place on steps formed by slitting and punching in the metal. —*B. M. Franklin, Hunter, Okla.*



WINDOW SHADES with aluminum foil on the outer side. They would deflect the sun's rays and act as insulation to keep the house cooler in summer.—*Gerald L. Hegel, Cincinnati.*



A HAMMER with a hinged handle that could be adjusted and locked in position for driving or pulling nails in corners and tight places.—*John P. Krzemien, Gowanda, N. Y.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by *Popular Science Monthly* readers. What is *yours?* We will pay $5 for each one published. Please use government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

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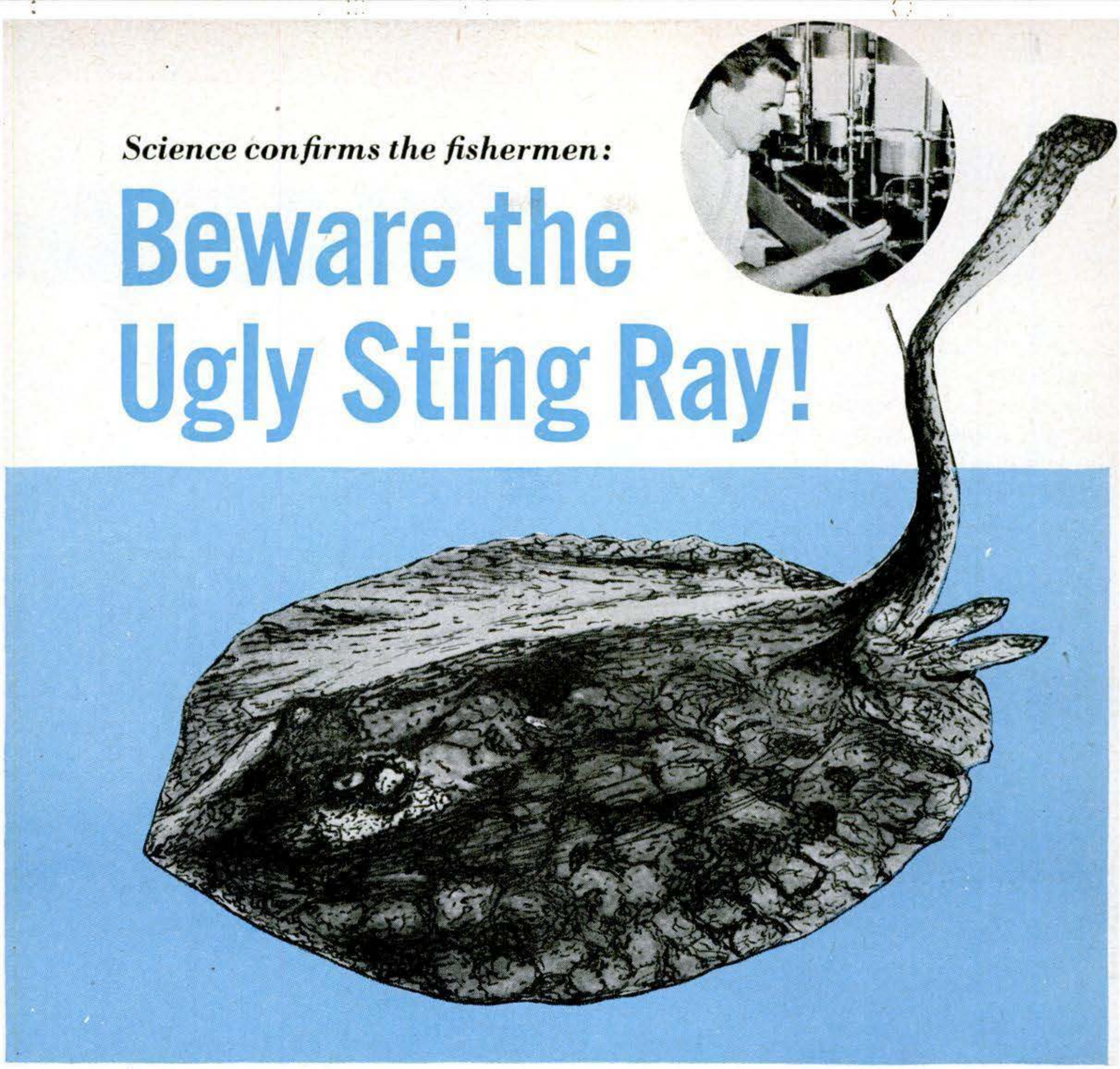
Science confirms the fishermen:

Beware the Ugly Sting Ray!



Sting on a ray's tail points at Dr. Russell (circle) studying sting-ray venom in laboratory.

Researchers report this queer fish will not only knife you but pour poison in the wound.

By Edward Hutchings Jr.

THOUSANDS of years ago fishermen and bathers learned to give a wide berth to the queer fish called the sting ray. This prudent practice is fully endorsed by the latest dope on these ugly critters from a scientific study of them now being made along the California coast.

At first glance, the small round sting ray most often encountered around American shores looks as harmless as it is useless. It is a flat, brownish fish, measuring anywhere up to 20 inches across, with a long whiplike tail. Its favorite activity is to lie motionless, buried under the warm sand or mud, in shallow water.

Obviously, it is no trick at all for a fisherman or bather to step on one of these creatures—and this is when the sting ray shows its ornery side. The pressure of a foot on its back provides the incentive, and the leverage, for the fish to whip its tail around and thrust its sting into the foot or leg of its victim.

This treacherous weapon is carried on the upperside of the sting ray's tail. A hard, bony structure, it has sharp barbs

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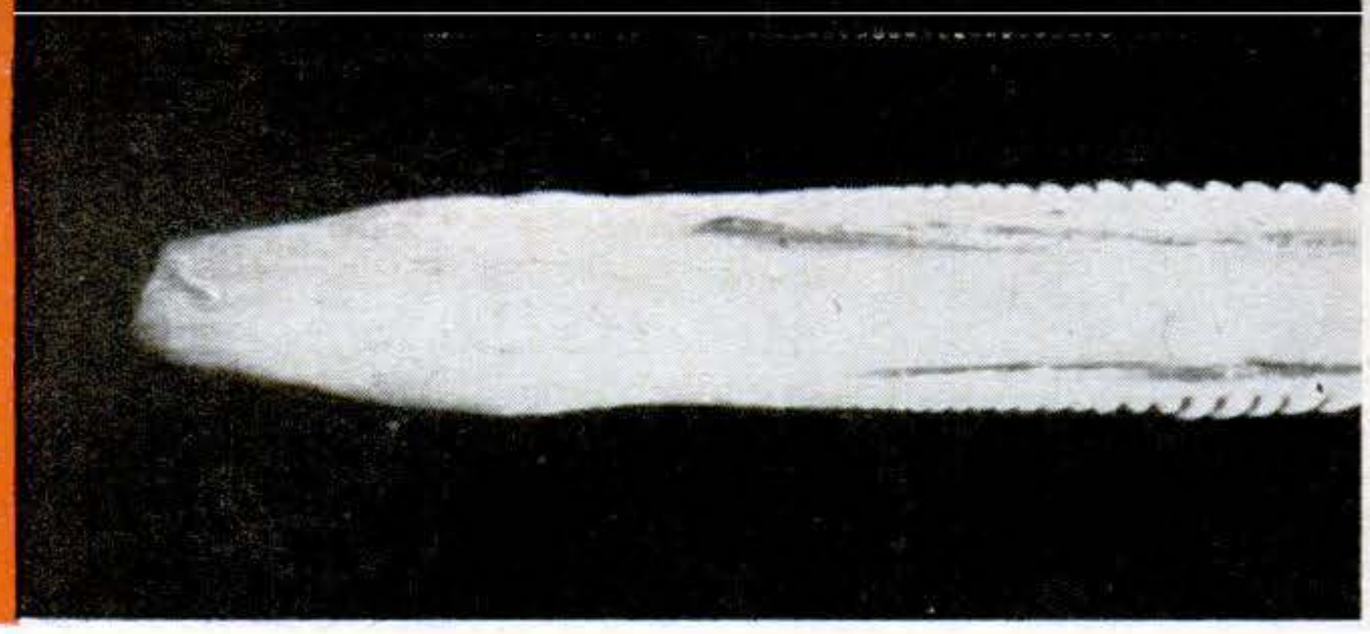
YOU CAN SEE in this close-up photo of the actual sting from a 25-inch ray why the Indian tribes in South America have for centuries used sting-ray spines on their spears and arrows. A man in Australia grinds and polishes stings this size and sells them for toothpicks.



along both sides of the last half of its length, like a two-edged saw. It is fiendishly designed to cause pain when the ray jabs it into a victim, and to lacerate the victim's flesh when the ray draws it out again.

An 11-inch ray usually has a sting about 1½ inches long; a 200-pound ray

ON BEACH at Corona Del Mar, Calif., Dr. Russell cautiously flips a small ray from net into bucket. In lab he extracts venom from the sting to study its effect on animals.

will have a 10-inch sting. Large rays can inflict serious, and even fatal injuries. A fisherman who mixed with a 10-foot sting ray off Australia was struck with such power that the sting went through his leg. And a woman was once wounded fatally when a ray drove its sting through her heart.

Even a sting from a small ray can be an unforgettable experience. Take the case of Joe, a 27-year-old employee of the California Fish and Game Department, who was struck by a round sting ray while seining in Alamitos Bay, near Long Beach. Less than two minutes after he was struck the sharp stabbing pain in his foot and ankle was so intense that Joe went into a state of shock. He was quickly revived, and soon began to have muscular spasms in his foot and leg. For half an hour he was dizzy, nauseated and in constant pain. Codeine gave him no relief, so he was given an injection of demerol, and in about 15 minutes he was able to hobble around on his injured leg.

The pain hung on for several hours. It was only occasionally sharp, though, and it was even further relieved when Joe soaked his foot and leg in hot water. By the next day the pain was completely gone. The wound itself took 16 days to heal. Because the pain from a sting ray is usually all out of proportion to the damage that can be caused by the sting itself, doctors long ago decided that it must be aggravated by bacterial infection, from dirt and slime left deep in the wound. Only in recent years has it become clear that most of this pain is probably caused by the sting's venom.

Doctor Becomes Fisherman

This venom has been the subject of a scientific study conducted by a Californian, Dr. Findlay Russell, since 1952. Dr. Russell began by trying to confirm the actual existence of sting-ray venom, went on to study its pharmacological properties, then came to consider its medical aspects.

[*Continued on page 224*]

THESE ARE AVERAGE-SIZE diamond sting rays collected by University of California researchers. Sting nearly four inches long can be seen halfway up tail of the ray at far right.

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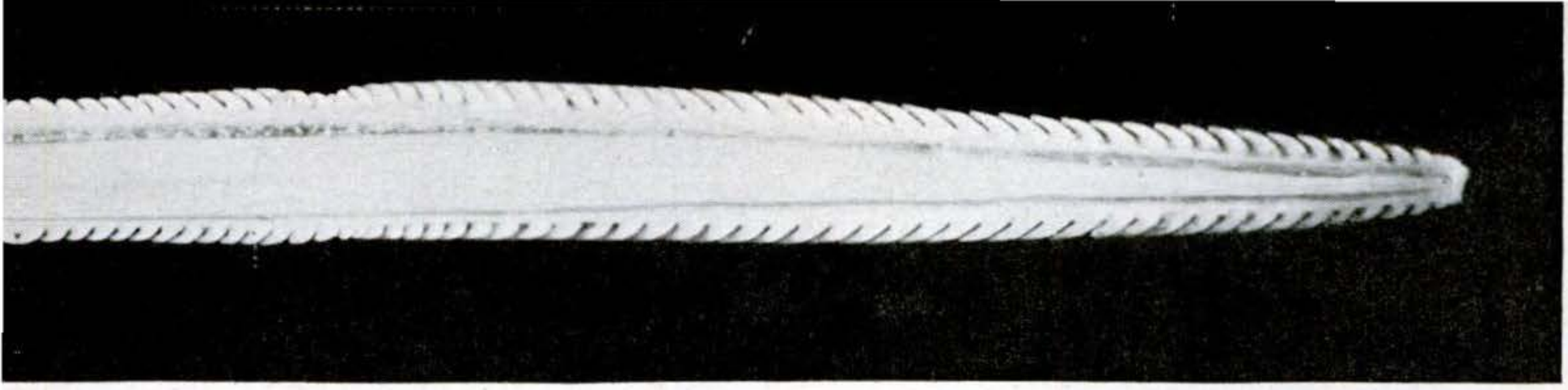
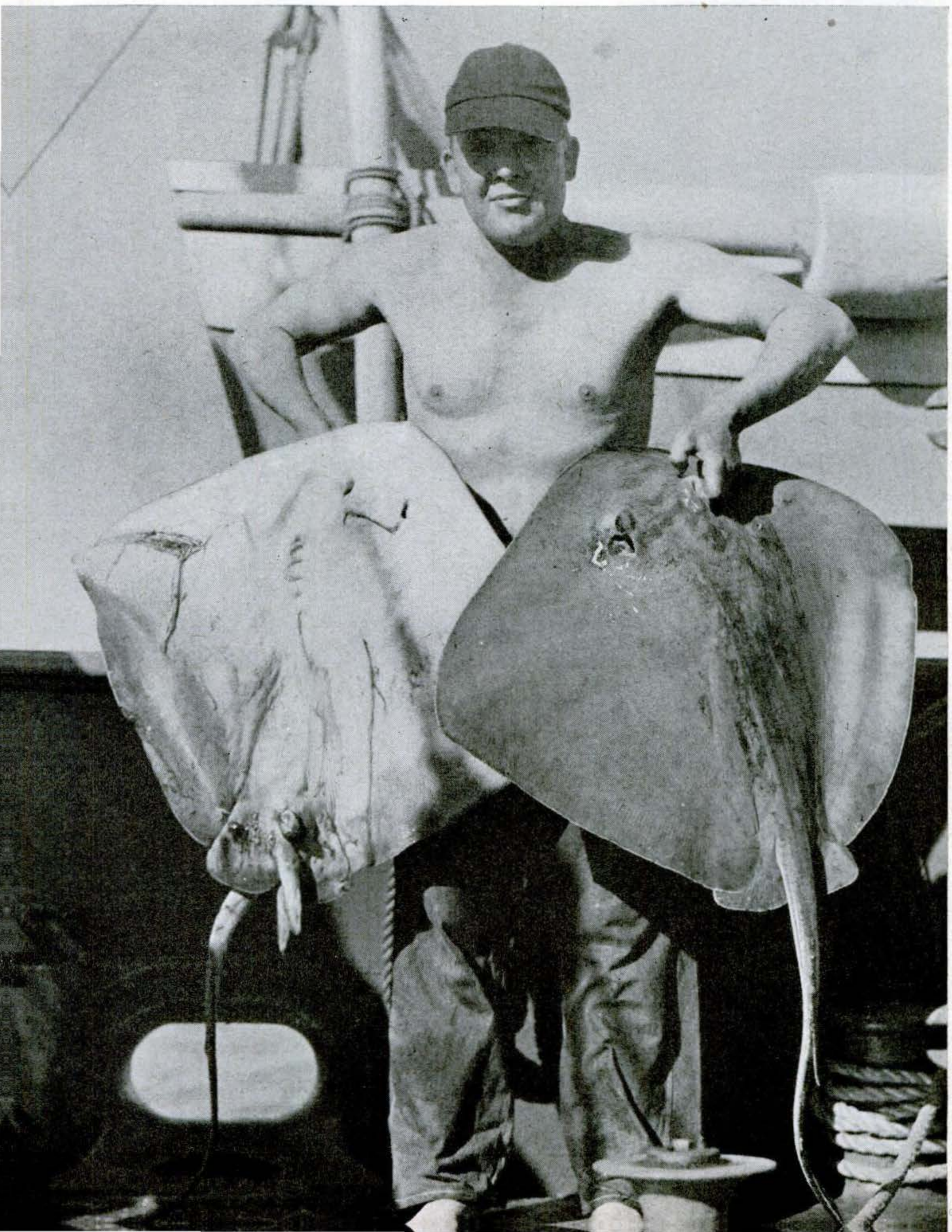


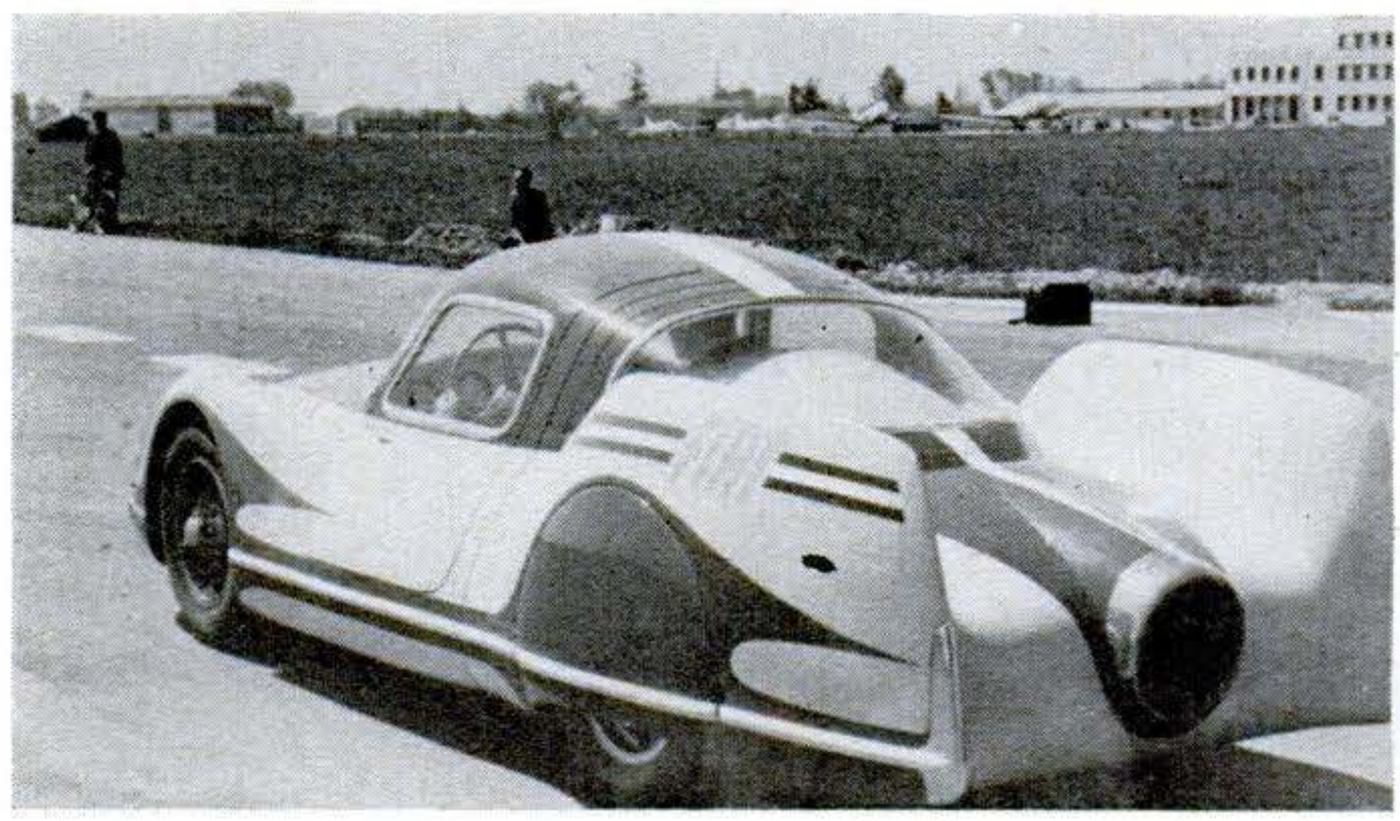


Turret Changes Lenses Fast on Still Camera

THE revolving turret, widely used on movie cameras for interchanging lenses quickly, has been adapted for use on a still camera. A miniature Rectaflex shown in Paris (left) swings any one of three lenses into position when you spin a wheel. Although bulky, the turret is said to be light in weight and not difficult to manipulate.

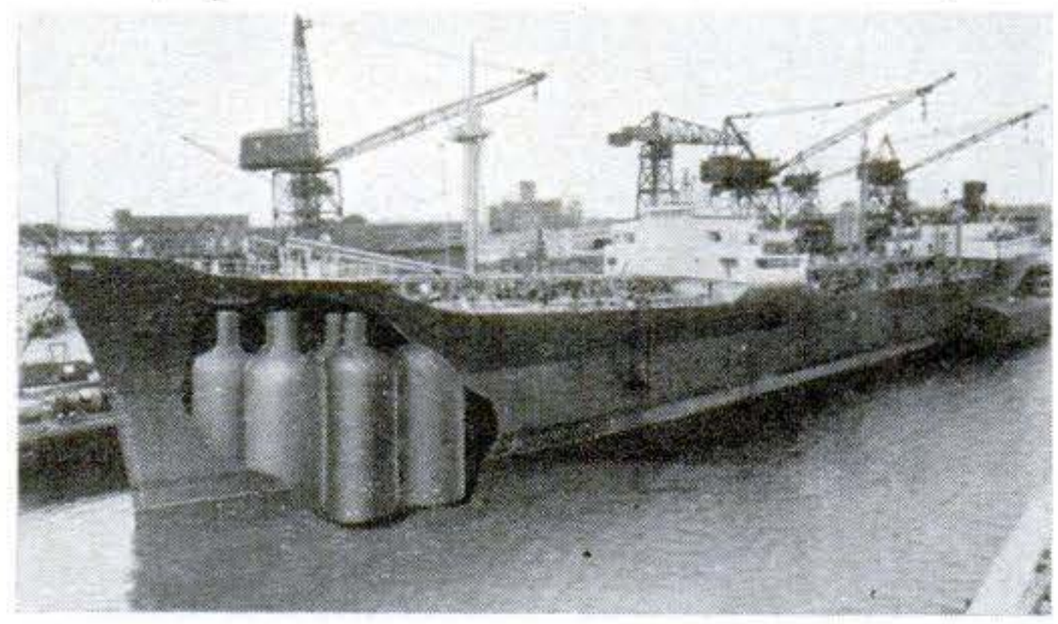
Italy's Turbo Car Hits 175 M.P.H.

AFTER five years of experimental work, the first turbine-powered Fiat has hit the track. Swirling gas as hot as 1,470 degrees F. spins the turbine at 22,000 r.p.m. to develop 200 horsepower. Two large rear fins give the car stability at a top speed of 175 miles an hour.



Kits Make Fancy Foreign Cars

A LOT of big car names have been added to the screwdriver assembly line. The boy above is at work on a Jaguar, while a Pegaso, Rolls Royce and Corvette stand ready to roll. Ideal Toy Corp., 200 Fifth Ave., NYC, makes the kits.



Acids Shipped in Rubber Casks

SIX rubber-lined tanks ride the hold of the SS *Marine Dow-Chem* to haul acids and caustic chemicals. Goodyear field men vulcanized the rubber with steam under pressure while the tanks—each 15 feet across and 41 feet deep—acted as heat containers.

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A broncobuster of the skies rides

Boeing's Jet Stratoliner

Tex Johnston, a test pilot in cowboy garb, calmly holds the 600-m.p.h. transport's reins as it goes through its first paces.

By Andrew R. Boone

TEX JOHNSTON is tall and rangy and he can spit into a 40-mile wind. He wears a cowboy's high-heeled boots and big hat, and he can spin you yarns from sunup to supper without repeating himself. And there is something else about Tex—when it comes to flying, he knows just about as much as there is to know.

When I chatted with Tex recently in Seattle, he was getting set to pull back on the control yoke and soar

SPEED IS IN EVERY LINE of the big, new brown-and-yellow Stratoliner, seen below as it was first rolled out of its hangar. Model above shows how it looks from overhead.

JET PLANES ARE AN OLD STORY to Tex Johnston (in the hat, natch), who was in the driver's seat when both the B-47 and B-52, USAF jet bombers, made their maiden flights.

aloft in the fastest passenger-type airplane the world has ever seen.

It would be the first flight of the first model of America's first jet airliner.

Tex Johnston, chief of flight testing for the Boeing people, allowed as how he would get this here flying machine unglued from the runway and mosey on upstairs and see how many knots she could make.

Slide Rules Predict Performance

The fact is, he already had a pretty good idea. He and the engineers had figured it all out ahead of time. Unless the slide rules were plumb loco, this airplane would turn up some 600 miles an hour in high gear and cruise at around 550.

Tex would be testing an airliner that —sooner than you imagine, maybe—will be flying from Los Angeles to New York in less time than it takes a fast train to make it from New York to Boston. It will be able to fly the Atlantic in the time it takes a motorist to drive from Kansas City to St. Louis.

Eastbound, with the prevailing winds, it will span the continent nonstop in about four hours. Westbound it may re-

How They Compare

	B-47
Span	116 ft.
Length	106 ft., 8 in.
Height	27 ft., 11 in.
Sweepback	35 degrees
Weight	200,000 lb. gross
Range	Over 3,000 mi.
Speed	Over 600 m.p.h.
Service Ceiling	Over 40,000 ft.
Power	6 GE J-47 turbojets, 5,800 lb. thrust
Payload	20,000 lb. of bombs

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quire an hour more. These speeds will chop three hours and 15 minutes off the present fastest west-to-east transcontinental flights and three hours off the fastest east-to-west flights.

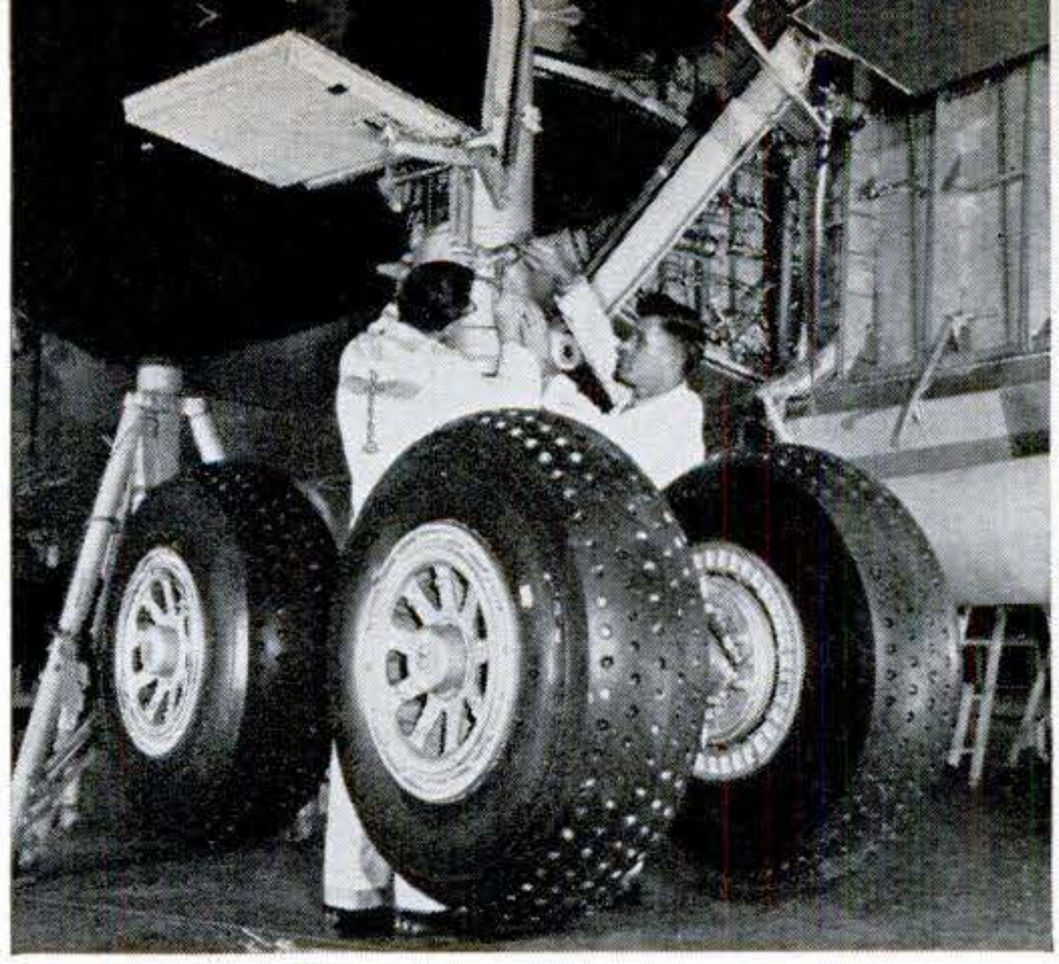
This airliner will fly twice as high as present propeller-driven airliners—up to 40,000 feet, or almost eight miles, of altitude. Jets *have* to fly high. At low altitudes, their speed rapidly diminishes. Jets need rare air to do their best.

Passenger Capacity Will Be Large

There will be a lot of other things about this particular airliner that Tex will be proving out this summer as he gets those spike heels and fancy-sewed toes on the rudder pedals. For one thing, it will carry a lot of people. Tex and his side-kicks don't know exactly yet, but they won't be surprised if it proves capable of toting 125 to 130 passengers. That's 45 to 50 more than the biggest of the current airliners will accommodate.

Then there is the way they plan to slow the Stratoliner down, once it's out of the air and in its landing run. They are going to turn the stream of jet gases from the engines around to blow the other way—and get aerodynamic braking by jet reaction.

Aerodynamic braking has a king-size by-product that may, in the end, prove to be one of the main reasons why jet transports are practicable. Here's the story:



BIG FEET FOR A BIG BIRD, the eight main wheels of the Stratoliner are mounted on two sets of tandem axles (left set, above). There are also two wheels under the plane's nose.

Drawback: Slow Thrust Recovery

The gas-turbine engines used in jet aircraft turn up five or six times as many revolutions a minute as piston engines. When they begin losing revolutions, their power to propel an airplane—that is, their thrust—drops off alarmingly. Worse, they don't react instantaneously to opening the throttle, as piston engines do. It takes precious seconds for them to recover their speed and thrust.

If the pilot of a jet airplane "misses an approach"—if he isn't at the right height,

B-52	STRATOCRUISER	STRATOLINER
185 ft.	141 ft., 3 in.	130 ft.
153 ft.	110 ft., 4 in.	128 ft.
48 ft.	38 ft., 3 in.	38 ft., 3 in.
35 degrees	Slight	35 degrees
Over 300,000 lb. gross	145,800 lb.	190,000 lb. gross
Over 3,000 mi.	3,000 mi.	Over 3.000 mi.
Over 600 m. p. h.	300-340 m. p. h.	Over 550 m. p. h.
Over 40,000 ft.	33,000 ft.	Over 40.000 ft.
8 P&W J-57 turbojets, 10,000 lb. thrust	4 P&W 3,500-hp. R-4360s, with GE turbosuperchargers	6 P&W JT3-L turbojets (similar to J-57s), in 10,000-lb.-thrust class
Restricted information	25,000 lb.	25,000 lb.

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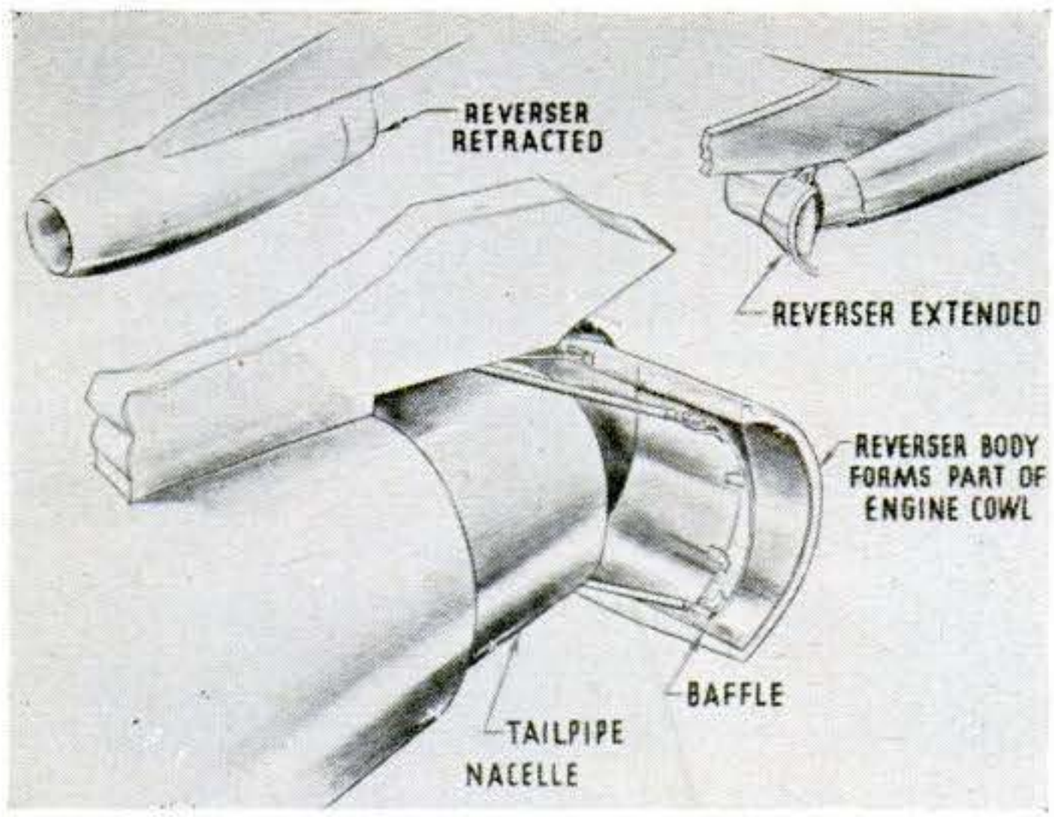


NEW KIND OF BRAKE, a retractable device that reverses the thrust of each jet engine without requiring reduced throttle, has been designed to slow the Stratoliner for landing.

at the right speed, when the near end of the runway flashes by underneath—it's touch-and-go on his thrust as he pours on the coal to go around and try it again.

Yet he has to reduce his thrust to get slowed down to land. That's where the aerodynamic braking comes in. By controlling the direction-of-flow of the gases from the tailpipes of the new airliner, the pilot can slow down or speed up the airplane at will without changing the speed of rotation on the engines. Instantaneous maximum thrust is his for the asking.

Drop-Off Engines

Tex Johnston has other safety devices at his command as he wrings out the new transport according to the syllabus of the test program. One of them sounds plain crazy—the engines are attached to the plane in such a way that, under certain circumstances, they can drop right off. They are swung on fixtures below the huge wing. If an engine gets out of hand, vibration and the wrench of suddenly frozen torque will cause it to slip its moorings. It's installed that way. It can go sailing off into space without rupturing any of the main structure of the airplane. A valve controlled from the cockpit shuts off the fuel supply. It's that simple.

Some other aspects of jet-transport flying are not. Noise is one of them. For all that the airplane and engine manufacturers have been able to do, jets are still a lot noisier than propeller airplanes. They roar—to people aground.

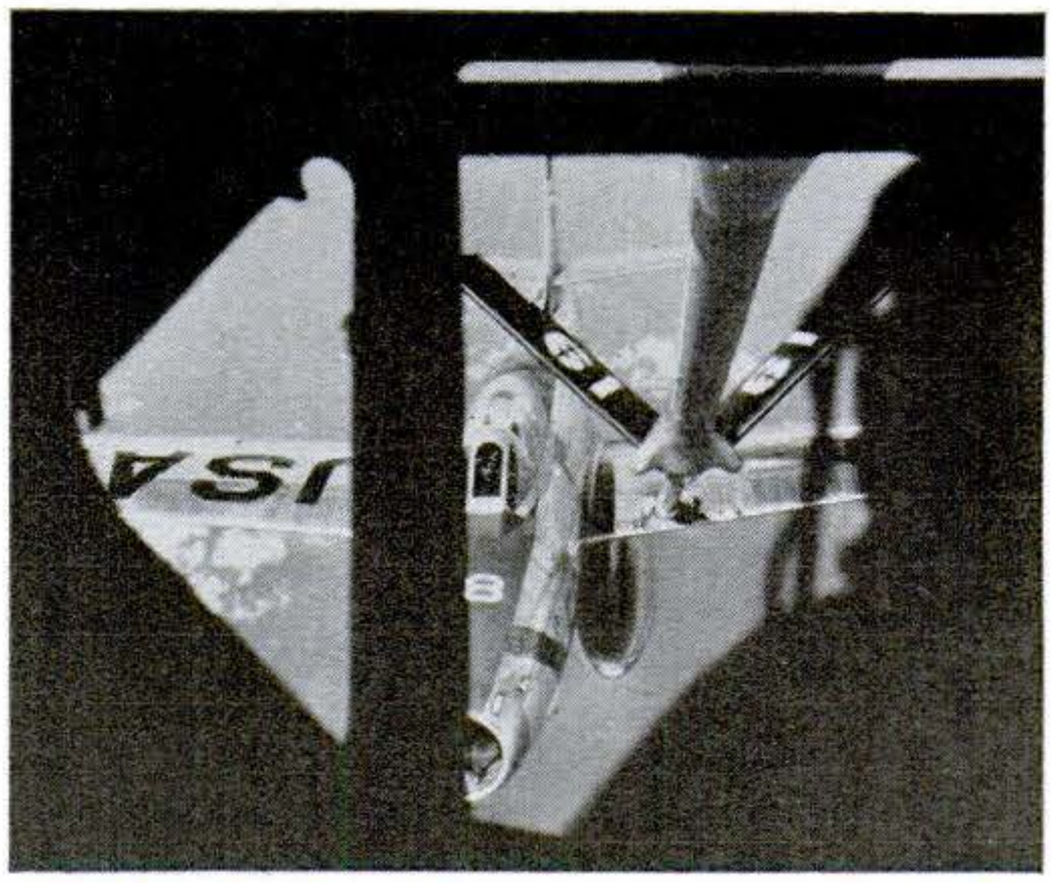
And jets are hot. When airline jets become operational in the U.S., Mother will have to keep Junior away from the tailpipes as the aircraft fire up. At full throttle, the gases issuing therefrom run a temperature of 350 degrees F. at a velocity of 475 miles an hour—a full 25 feet away.

Passengers Can't Get Shakes

As anyone knows who has read accounts of flying in the British Comets—grounded recently for a review of design and performance in view of some accidents—jet flying is as smooth as silk. Unlike that in propeller aircraft, there is no vibration. Nor, for most of the passengers, is there any noise. There is only the swish of a giant surf, the friction of the wind on the fuselage. Passengers sitting aft do get a faint echo of the bellow of the jets.

Tex Johnston's new jet airplane is not actually a transport. It's decked out experimentally as a tanker plane for a long-range bomber fleet. As such, it's being tested with an eye to selling it to the U.S. Air Force. But the airplane is shaped like a transport, and Boeing is going to put it through its proving trials with a transport in mind, too.

[Continued on page 232]



REFUELING IN FLIGHT can be done at 500 miles an hour at 40,000 feet, and at far greater distance from home base, when Stratoliner-type planes are used as tankers.

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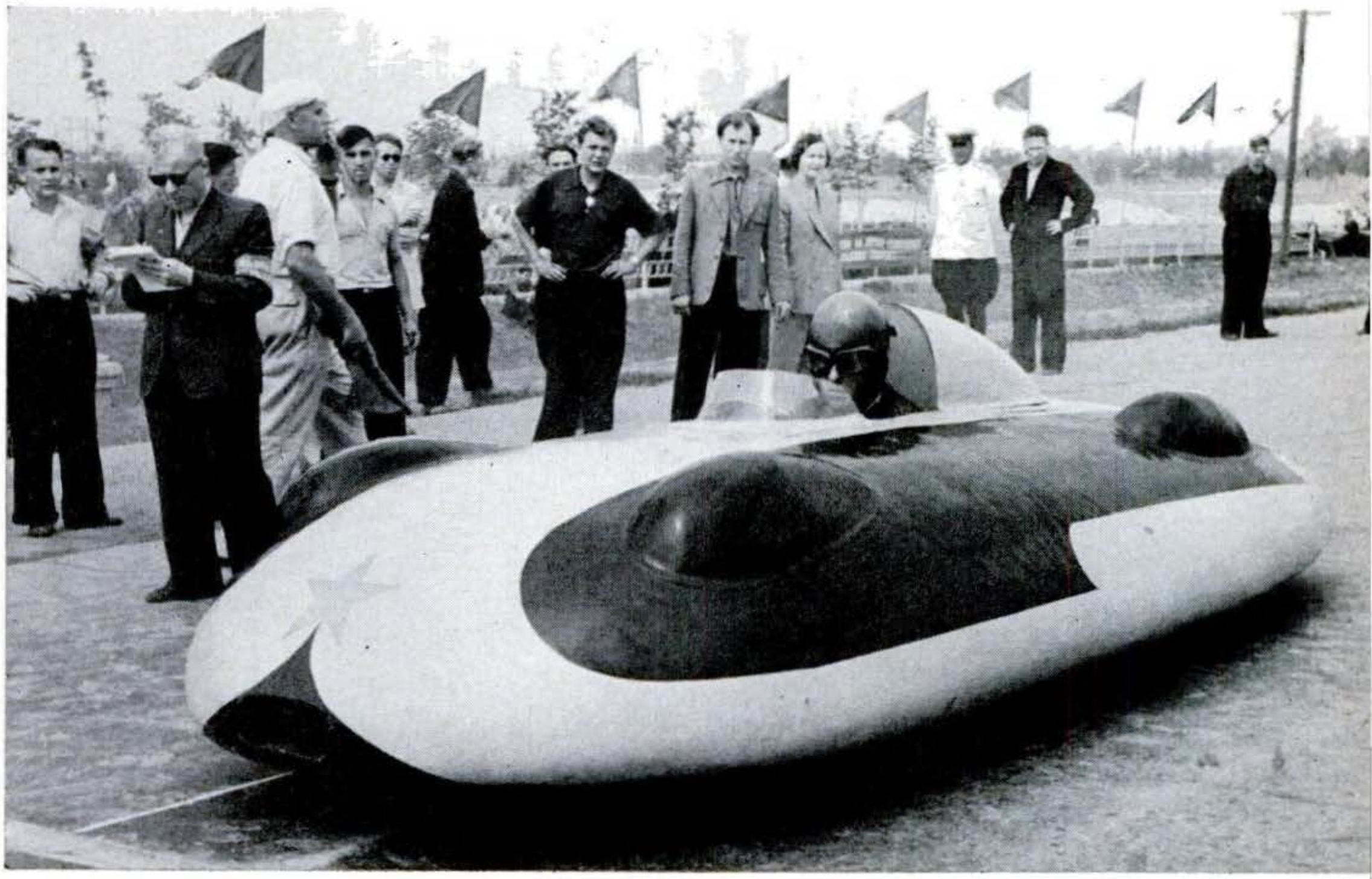
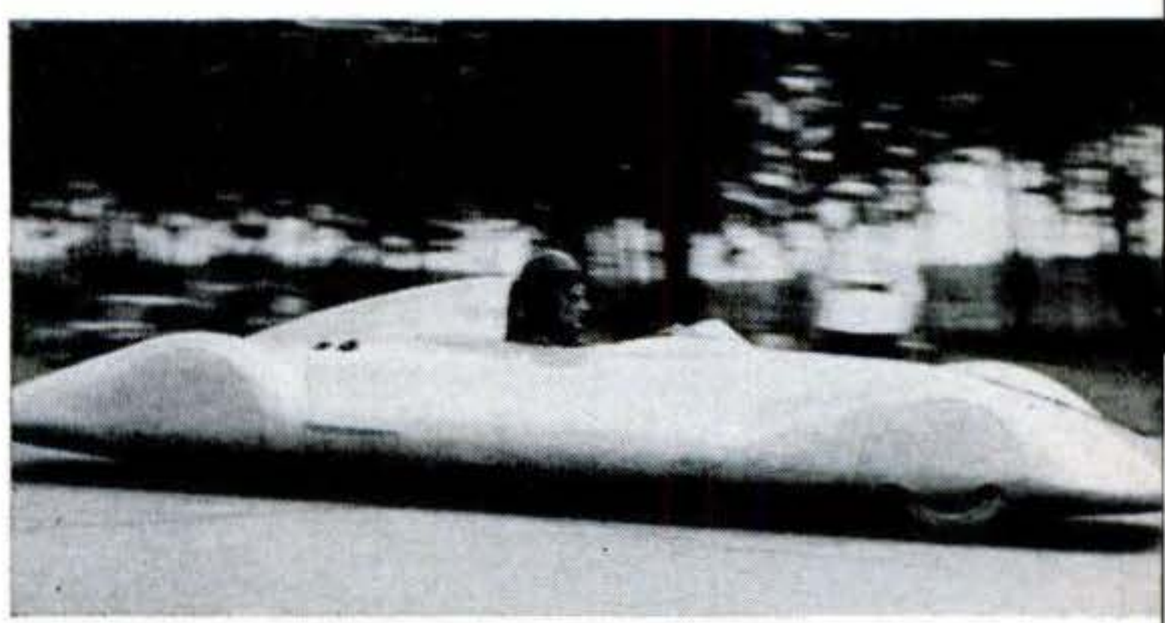
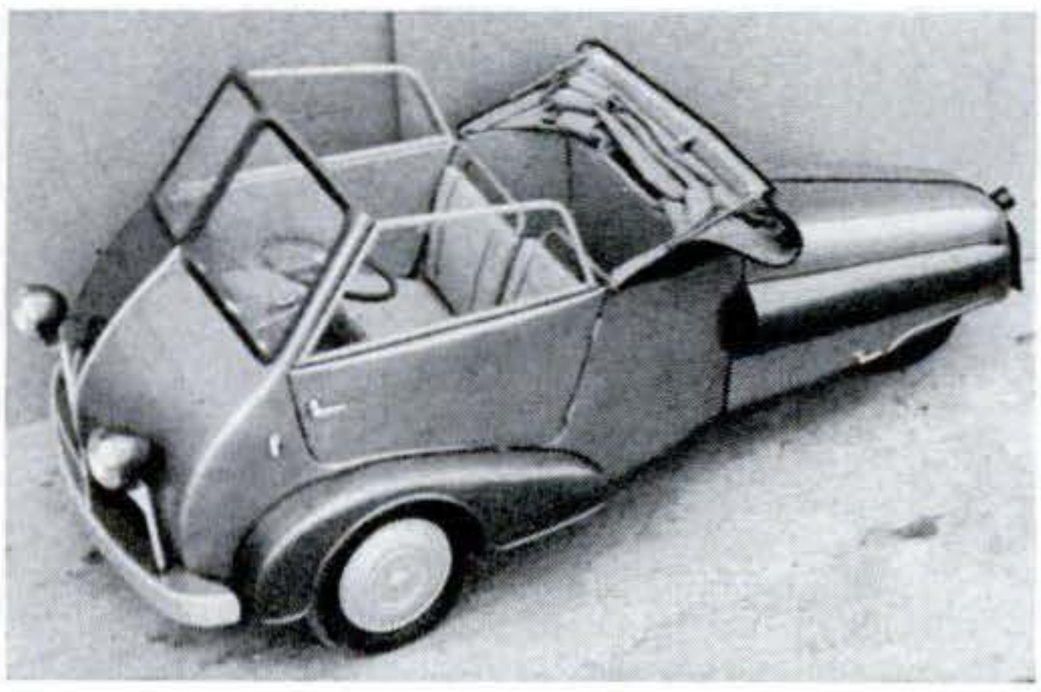


Russian Zvezda Goes Z-z-z-zip

THOUGH the Russians don't claim to have invented the racing car, their midget speedsters are evidently in a class by themselves. The one above, a Zvezda, is said to have broken eight world's speed records unofficially. Another, a Kharkov-250 (right), covered three miles at an average of 132 m.p.h. It was powered by a two-cycle engine of 15-cu.-in. displacement (1/16 as much as a Ford V-8's).





Austrian Car Is Stingy on Gas

THREE'S a crowd in this new, three-wheel Viennese convertible, but it is reported to go more than 100 miles on a gallon of gasoline. Its one-cylinder, two-stroke, nine-horsepower engine gives it a top speed of 50 miles an hour. Gearbox has five speeds.

Swiss Scooter Resembles Plane

THIS new Swiss motor scooter has an airplane-type, side-hinged canopy and a sharp, planelike nose with a single headlight in it. There is room for one passenger behind the driver of the three-wheel, eight-horsepower vehicle. Engine is in the rear.

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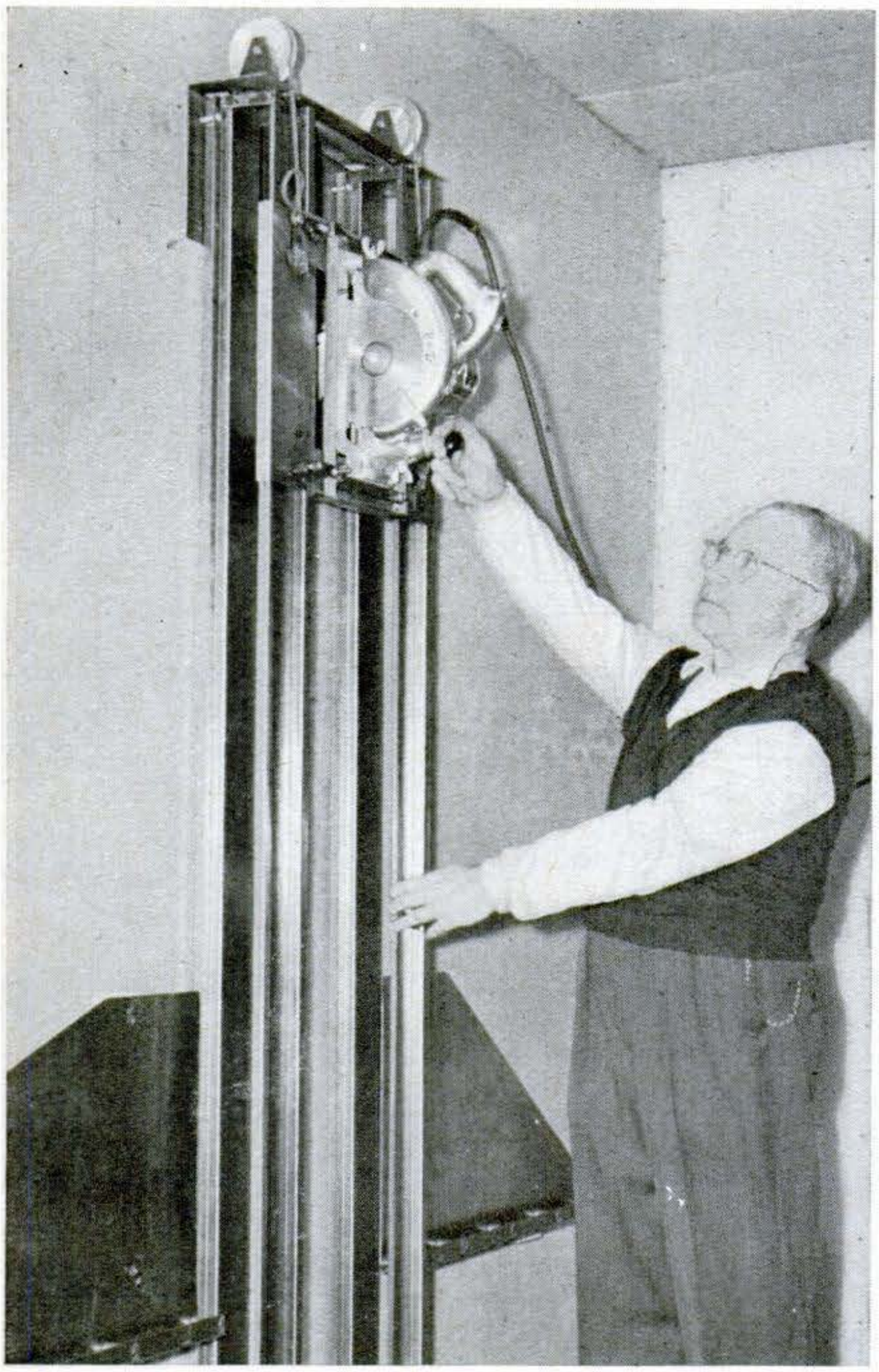
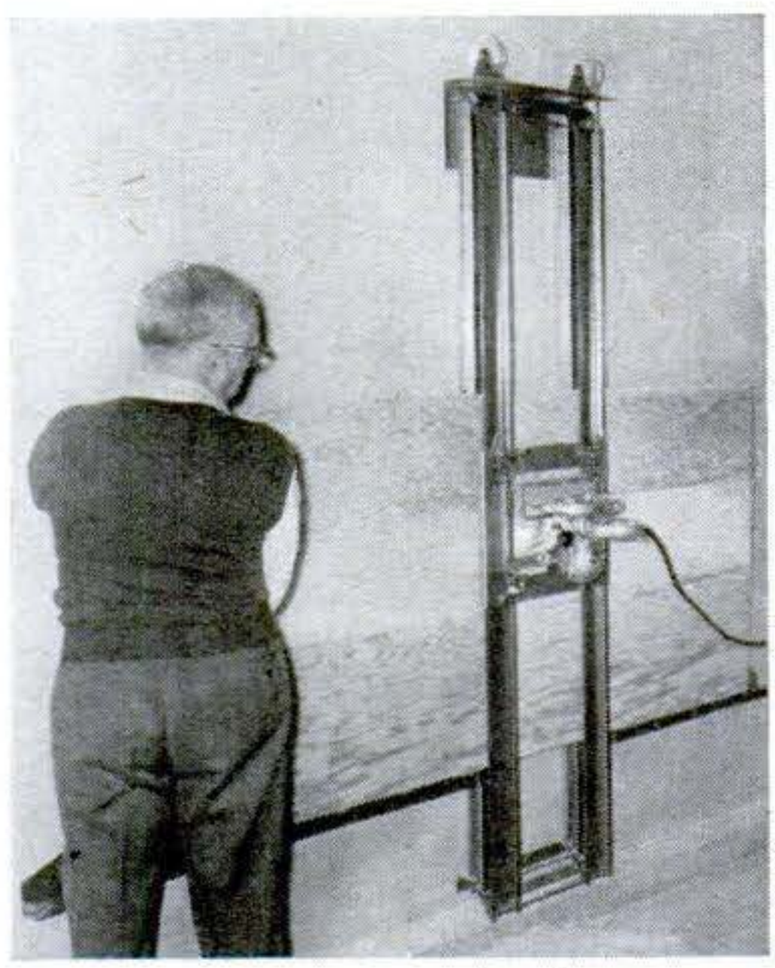
Superaccurate Saw Runs on Tracks



WALL TRACKS guide the cut of this precision plywood saw. The saw carriage is counterbalanced by weights hidden in the rear track. The outer track frame, hinged at the top, can be clamped against the stock to be cut by applying foot pressure at the bottom. Rollers set into a narrow shelf (at lower left, above) support work.

PLYWOOD IS ROLLED into place under the saw and clamped with the top track. The saw can be hand-fed or will cut by gravity if a one-pound weight is hung on it. As the work-supporting shelf and saw track are at right angles, the cut is sure to be square.



RIPPING PLYWOOD the long way is easy, too. By loosening a couple of clamps, the portable saw can be turned at right angles to the track. It is clamped at a height that will rip to the desired width, and the work is fed in on the roller shelf by hand.

IF HE had not bought a new house two years ago, Ira E. Price of Cleveland probably wouldn't be an inventor today.

The house gave him space for the home workshop he had always wanted. In building the new furniture he had promised his wife, Price found it hard to get accurate miter cuts on his bench saw. By the time he finished, he was sure he could build a more accurate saw.

What Price calls his complete sawing machine cuts to hairline accuracy—within 1/256 of an inch, he claims. Instead of the five- or six-inch protractor head of

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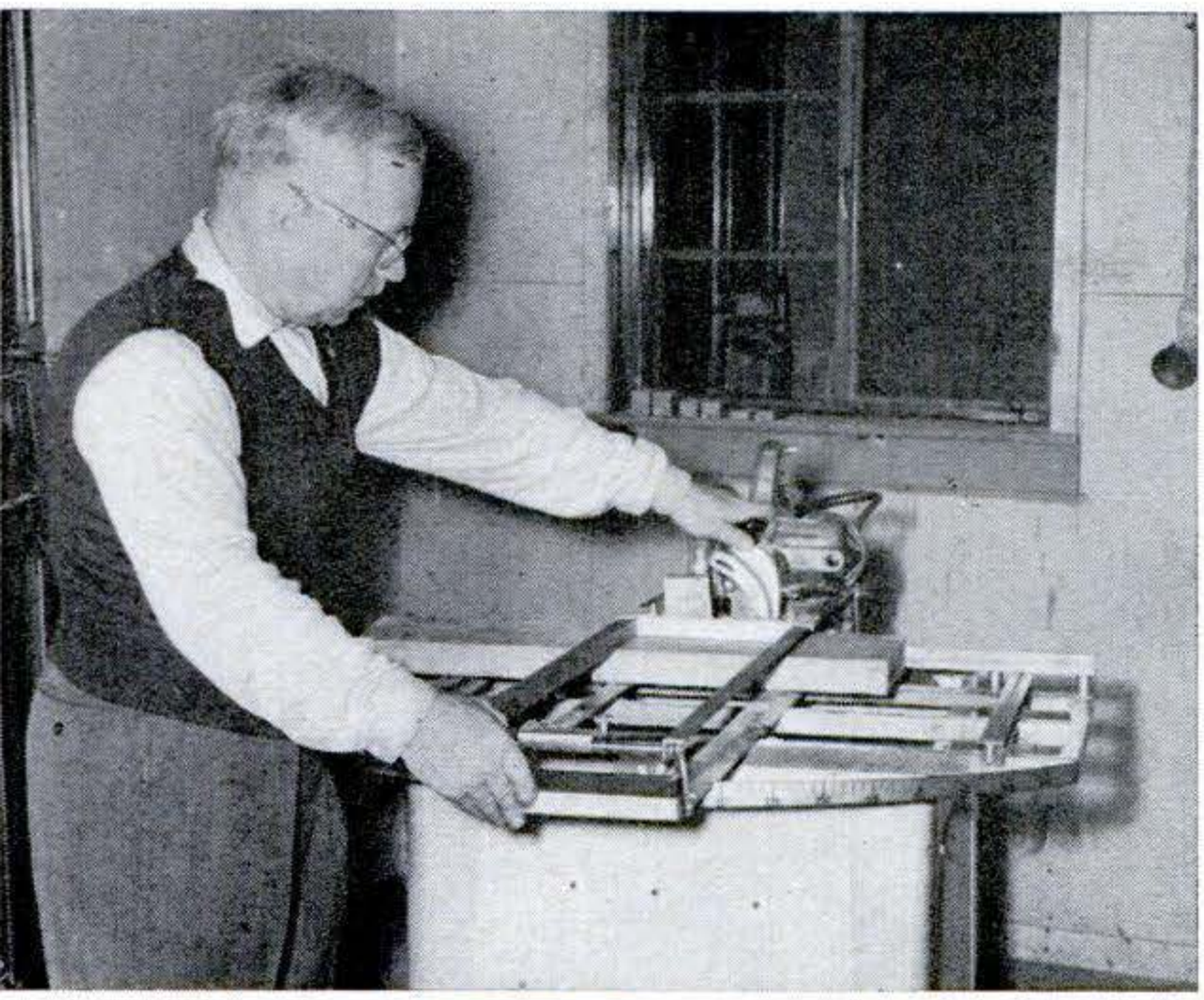
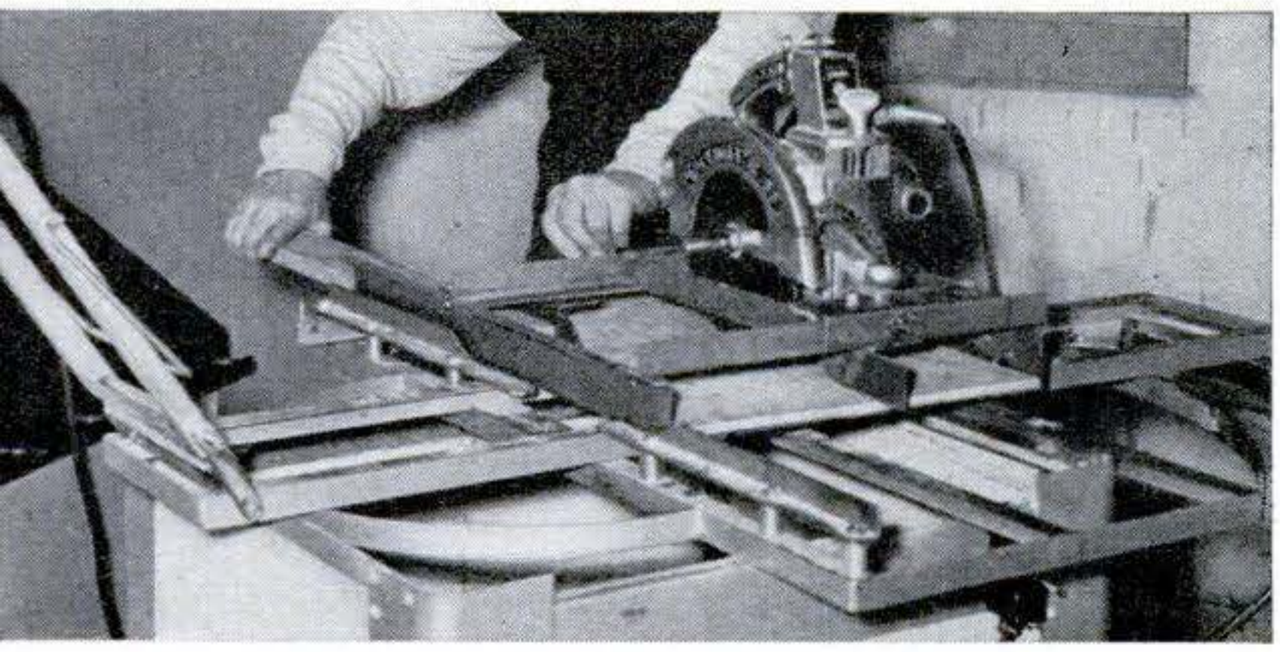


FOR CROSSCUTTING, a portable saw slides along the upper track of this general-purpose machine, Price's first invention. The work, aligned against a fence at the rear, rests on the lower track and is clamped down by the upper one. Both tracks can be set either square to the fence or at any angle up to 45 degrees by a big graduated hoop in front.

the ordinary miter gauge, it has a hoop of almost 24-inch radius on which the degree marks are fully half an inch apart. This makes it easy to set the angle by eye within a fraction of a degree. Any portable electric saw can be used. It runs on tracks. The work is clamped under it.

Not stopping there, Price adapted the same idea to the awkward task of cutting large sheets of plywood. He mounted vertical tracks on the wall, counterbalanced the saw, and built a roller track for the plywood. He has applied for patents on both saws. END



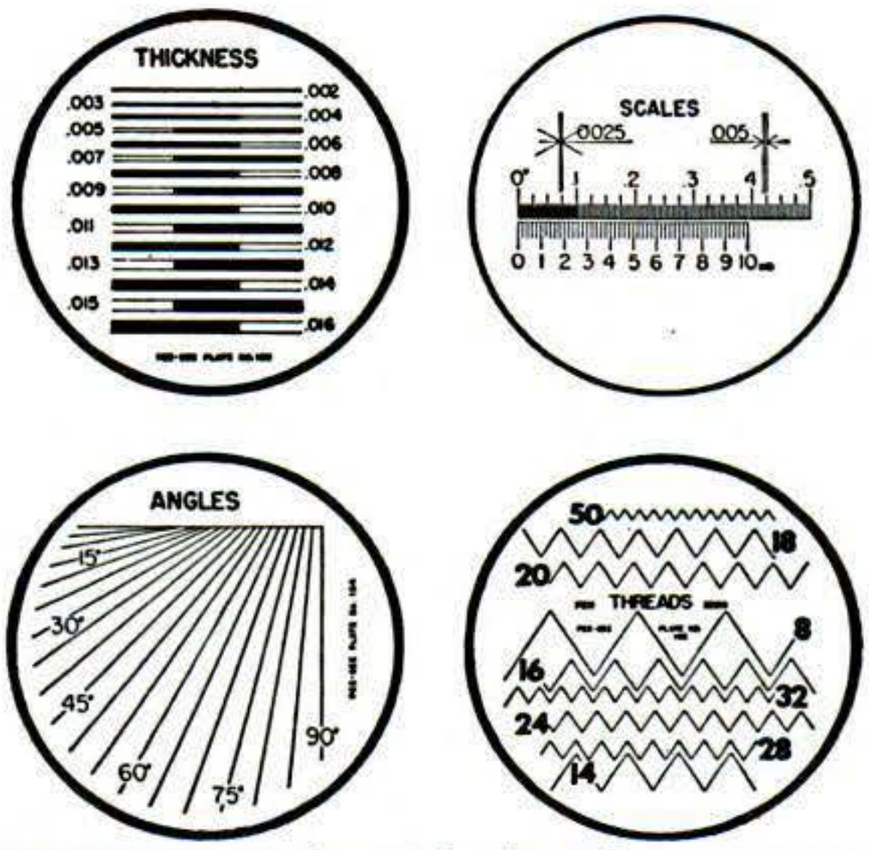
FOR RIPPING, the upper track is swung back and the saw mounted at right angles to the lower track. A spring holdback and a splitter help hold work against the fence. Stock up to 11¾ by 2¾ inches can be ripped.

Eye Mikes Thousandths

MOUNT a lens before a transparent scale or gauge and you can measure small objects visually. This pocket-size comparator has a six-power lens, quick-acting adjustment, vernier focus, and interchangeable reticles against which work is gauged.

The instrument is clear acrylic plastic and anodized aluminum. Made by the National Tool Co., 11200 Madison Ave., Cleveland, Ohio, it comes with a reticle having scales in inches and millimeters at $9.75. Six extra reticles at $4.25 make it possible to gauge angles, threads per inch, thicknesses, small diameters, and radiuses.

Without reticles, the lens can be used to inspect cutting edges or surface finish, check defects in castings, metal type, or engravings, locate holes accurately and do fine model or instrument work.



SCALES RETICLE furnished with comparator (upper right) measures to .5″ in steps of .0025″, to 10 mm. in steps of .2 mm. Others gauge thickness, angles, threads.

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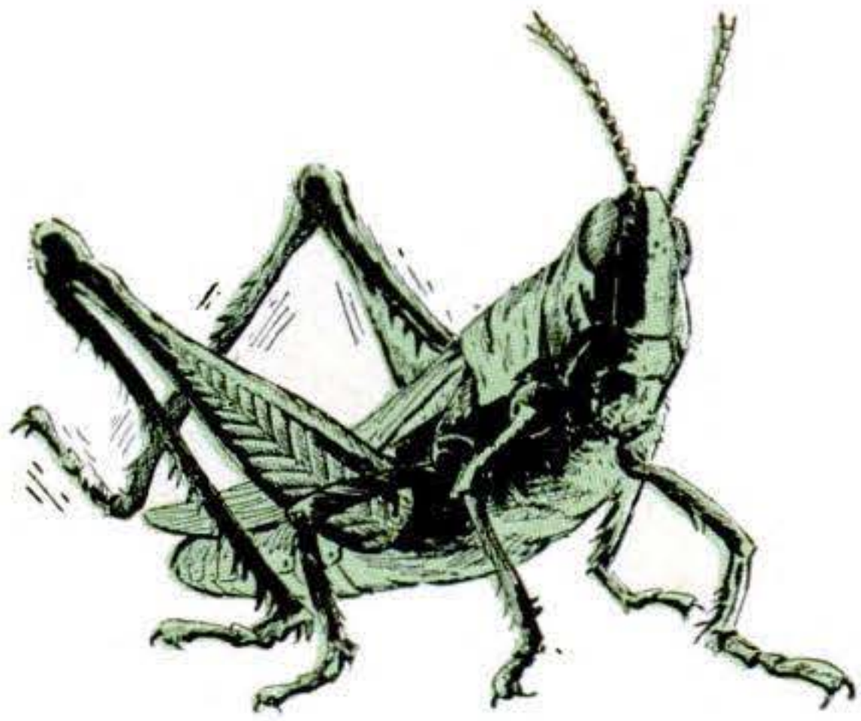


Gus Meets an Invasion

Taming old Ezra's tractor in time to save his hay from the hoppers has Gus hopping, too.

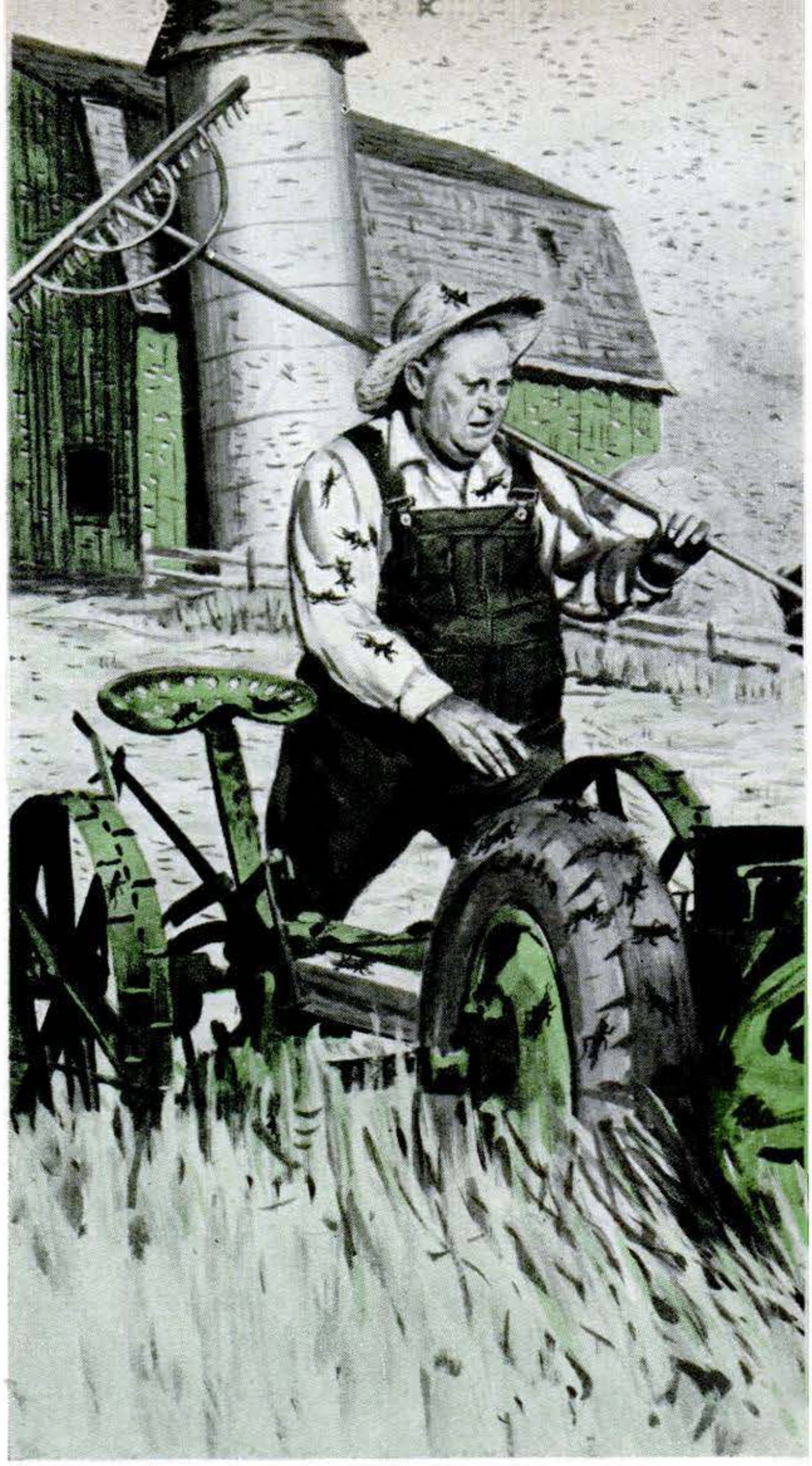
By Martin Bunn

BUSINESS was rather quiet around Gus Wilson's Model Garage when that hot east wind started blowing. The rush of the harvest season was still more than a month away. But with that wind came the grasshoppers—and action aplenty.

The hoppers swept over the countryside. Up to two inches in length, they had been appearing periodically in the area, but the oldest residents declared that they had never before seen such hordes of the pests as now invaded the fields.

Farmers sprang into frenzied activity, moving into the fields to cut the green grain and stack it for hay, before the hoppers ate it to the ground. Cars skidded into ditches on the highway, radiators boiled from becoming clogged with crushed grasshoppers.

Gus Wilson and his helper, Stan Hicks, found themselves busier than apple pickers in a hail storm.



Swiftly, Gus checked the distributor cap for

In the midst of the confusion came an urgent telephone call from Ezra Hendricks, who ran a farm a few miles out of town. Ezra was an irascible old character who with his close neighbors, Pete Blinstock and Tom Hanratty, was often a source of amusement to Gus.

Gus Gets a Call for Help

"Get on out here, Gus," Ezra Hendricks yelled over the telephone. "The danged hoppers are eating my place bare to the bone, right before my eyes."

Gus grinned at Stan Hicks, brushed a

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cracks, the primary and secondary wiring for breaks. "Let's try her now, Ezra," he said.

grasshopper from the back of his neck.

"You don't tell me!" he roared. "What do you want me to do, Ezra? Come out and shoo 'em away?"

"No, you lantern-jawed idiot," Ezra howled. "I'm cutting my grain and the tractor won't run."

The grin left Gus's features. This could be serious. Gus had put that queer old tractor—a converted auto—in shape for harvest hardly two months back. A balky tractor at this time, with every rig in the country busy, could cost Ezra tons of valuable hay.

Gus tossed his field kit into his car and took off for the Hendricks farm. When he arrived he found not only Hendricks, but also his two neighbors, Pete Blinstock and Tom Hanratty, huddled around the tractor. A hayrake and a hayrack, both horse-drawn, stood close by.

Friends in Need

Despite their constant wrangling, these three old codgers were the best of friends. Blinstock and Hanratty had rushed to aid Ezra in putting up his threatened hay.

"You old goat," Hanratty was yelling, shoving his round, florid features within inches of Ezra's gray, bristling beard. "I tell you the whole shebang's haywire,

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from stem to stern. I could cut more hay with a dull scythe."

"The gas tank's full of water," Pete Blinstock insisted. "Old Ezra's so tight that he cuts his gasoline half and half with water."

"Bah!" Ezra exploded, his tattered hat crawling with grasshoppers as long as a man's finger. "Here comes Gus Wilson. He'll have this thing perking like a kitten in no time."

"She'd better perk," Gus said grimly, jerking his kit from the car and preparing to go into action. "How's she act, Ezra?"

"Won't pull the hat off your head," Ezra grumbled. "Jerks along, backfiring to beat the band. Sounds like a Gatling gun."

"Backfiring, eh!" Gus grunted, stuffing tools into the capacious pockets of his coveralls. "Ignition trouble."

The cover for one side of the tractor's hood had been removed to let the engine run cooler in the stifling weather. Swiftly, Gus checked the distributor cap for cracks, the primary and secondary wiring for breaks.

"Let's try her now, Ezra," he said, stepping back.

Motor Runs—but Gus Isn't Happy

Ezra stepped on the starter. The motor ran smoothly. This might be one of these jobs that haunt garagemen. You have a balky engine, go over it, finding nothing wrong, yet in some puzzling, mysterious manner you have corrected the trouble. But Gus didn't like it. It was too easy.

"I'd better ride around the field with you once," he told Hendricks, climbing onto the step behind the right front wheel, bracing himself on the frame with a knee.

Gus squatted down as they got under way, his ear attuned to the motor, feeling the shower of grasshoppers on his back as they came from the falling and disturbed grain.

As they completed a circuit of the field, Gus dropped off before the farmhouse, waved Ezra on. Blinstock and Hanratty picked up the reins of their teams and began raking and forking hay into the rack for stacking. Mrs. Hendricks, a buxom, gray-haired woman, emerged from the house to greet him.

"Are you okay?"

"The only time that you ever come to see us, Gus, is when we're in trouble," she said. "Now, you come right up to the house and have a snack before you go back to town."

Trouble in the Air

"Now, don't you go to tempting me, Ma Hendricks," Gus protested, thinking of Stan Hicks all alone at the garage.

"And don't you try to dodge me, Gus Wilson," Mrs. Hendricks said firmly, and she took Gus by the arm and urged him toward the house.

In the cool, high-ceilinged kitchen, facing pie and milk that had his mouth watering, Gus paused with his first bite in mid-air. Borne on the wind came the sounds of distant explosions and loud voices raised in wrath. He got up, rammed his hat down on his head and made for the door.

"Excuse me, ma'am," he said. "Sounds like we got trouble again."

At the corner of the field he waited for the tractor, which was coming on slowly, bucking and backfiring. There was a note to the motor that had a familiar ring to Gus, yet still seemed somehow different. He couldn't quite pin it down. The engine seemed to run on all cylinders, then miss on one, clear up, miss on two. At times it seemed to be running on only three of the six cylinders.

Gases from unfired charges gathered

[*Continued on page 194*]

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MECHANICS
and
HOMEBUILDING

A Project for Each Weekend of the Month

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How an expert does this Saturday-morning job

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It's just three inner tubes on a wood frame

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Why have noise underfoot in your kitchen?

Shine Up Your Car for the Parade

An expert shows you how to turn the family bus into the belle of the July Fourth traffic brawl.

By Sheldon M. Gallager

WALTER A. HALL is a guy who *likes* to wash his car. Perhaps that's because he is so awfully good at it. In his 23 years as a research chemist in the Finishes Division of Du Pont, "Red" Hall has picked up quite a few pointers on the care and finishing of the old family buggy.

"Why does it always seem so hard to get a good shine on a car?" we asked.

"Nothing really complicated," Red said. "Mostly it's thoroughness, plus maybe a few little things that the average guy doesn't bother with, like using the wrong cloth or your wife's laundry soap instead of a special auto detergent."

We must have looked unconvinced.

"Here, I'll show you," he said, motioning toward a neighbor's car across the street. "There's a dark maroon job, one of the toughest colors to keep in shape. It's not a new car and it needs a bath pretty badly. Fair test?"

We agreed it was.

"How long does it take?" we asked.

"Actually," Red said, "you could do the whole thing in about four hours, pushing it a bit, of course. But it makes a fine weekend job if you wash one day and do the cleaning and polishing the next. That way, you're also sure that the car is completely dry before you start the elbow work."

For the next few hours, we watched while the master worked. The accompanying photos on this and the next two pages show you how you can use the same tricks to put a gleaming finish on your car.

1. HOSE DOWN CAR FIRST to loosen caked-on dirt and eliminate streaks that sometimes occur when washing water drips down over dry parts of car. Never wipe dirt with dry cloth—you'll simply grind it into the finish. Dirt won't come off, but the paint will.

5. REACH, BROTHER! When rinsing top, hood and back, don't forget that spray will push some suds back on clean side, so keep walking around car until all suds are off. Wash suds out of the rain gutter, too, or they'll drip down later and spoil your job.

9. WINDOWS ARE WASHED right along with car, but do need drying to prevent water-spotting while car itself does not. Use detergent suds on outside, merely a damp sponge cloth on the inside, as above. Even stickiest bugs will yield to water and elbow grease.

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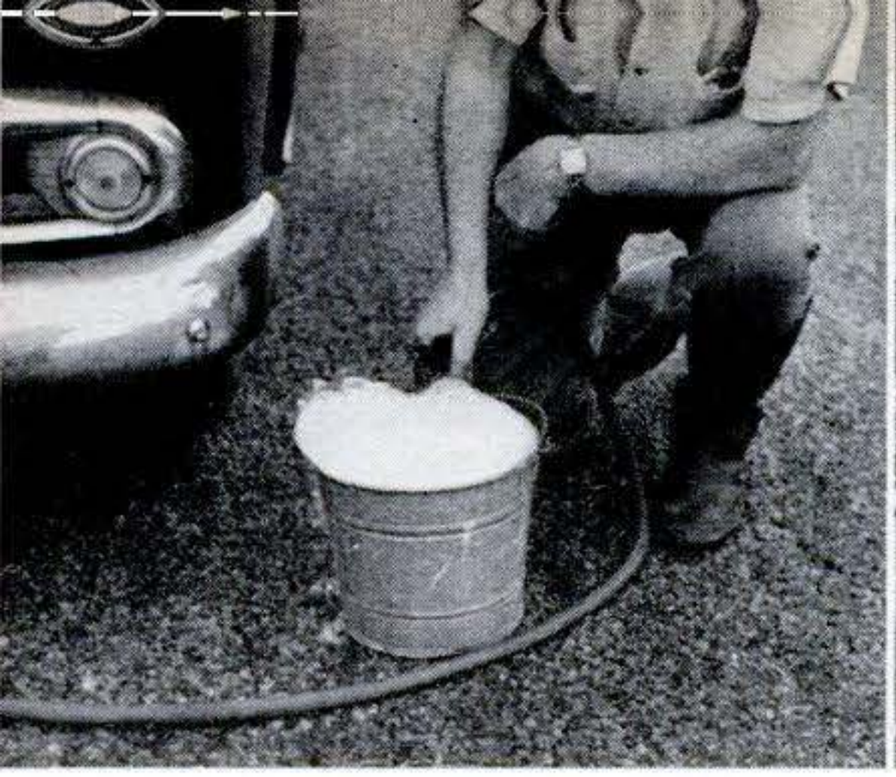


2. BE SURE TO USE special auto detergent, foamed into suds with hose. Ordinary soap leaves scum that dulls finish; house detergents hold dirt in suspension, may leave it on.

3. START AT TOP and sponge detergent on only half the car at a time. Working in small sections prevents drying of detergent that may cause streaks if it is left on finish.

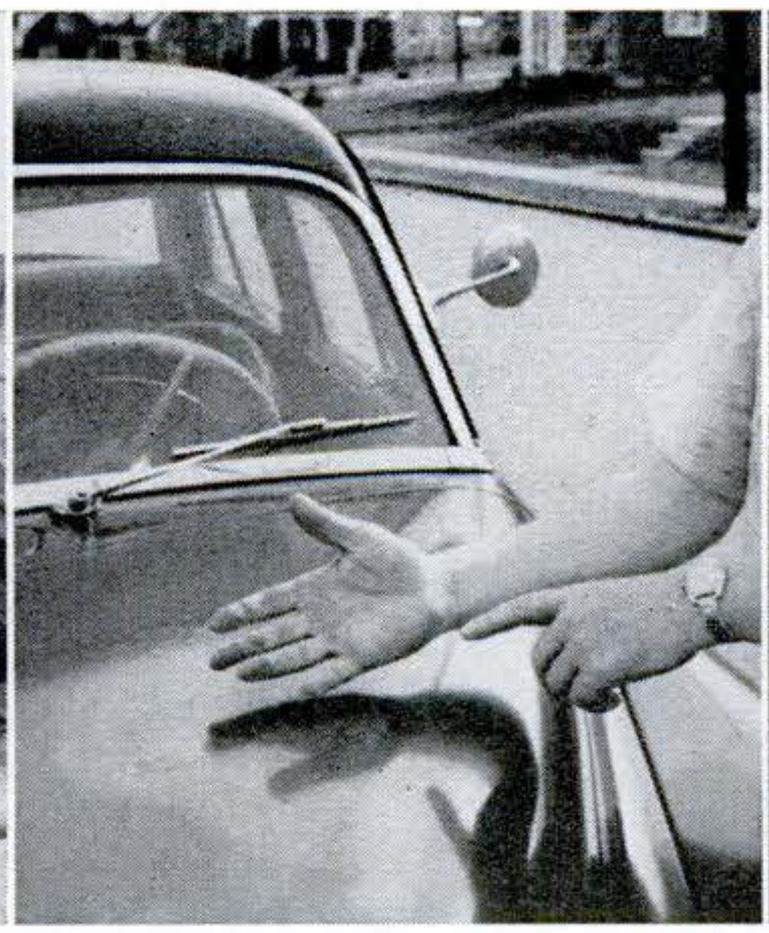
4. RINSE SUDS OFF IMMEDIATELY and check for dirt. Very grimy cars may need second or third sudsing for thorough cleaning. Trigger-type hose nozzle controls water easily.

6. FINISHED ALREADY? No, just throwing out the old water and changing to new. This, says Red, should be done twice during the washing to avoid re-using dirty water.

7. FLUSH ALL DETERGENT out of body cracks and under trim so it can't ooze out later and streak your finish. Rinse sponge often to remove dirt that might scratch car.

8. WASH CHROME in same way as the rest of car. Skim only surface suds from the pail so you don't pick up dirt settled at bottom. Humpback sponge is easy to grip, gets in corners.

10. WHEELS COME LAST. After sudsing and rinsing these, also spray underside of car to wash off salt and other road-conditioning chemicals that may cause corrosion of metal parts.



11. SO YOU THINK IT'S CLEAN? Even after a thorough washing, look what rubs off. This is dead pigment—nothing to get alarmed about, but it's why you need a cleaner, too.

12. RUB, BUB—that's the secret of a really good cleaning job. Red uses a small sponge balled up in his fist and scrubs on liquid silicone cleaner with short, brisk strokes.

Please turn the page for more car-cleaning tips.

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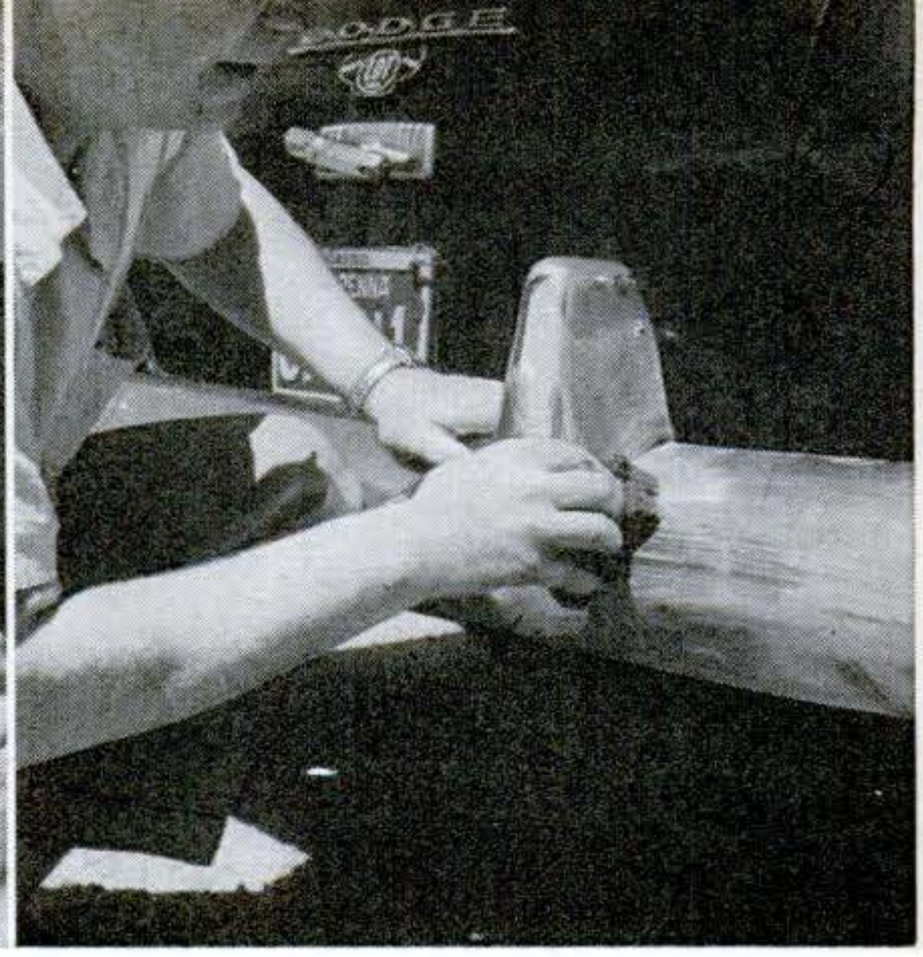
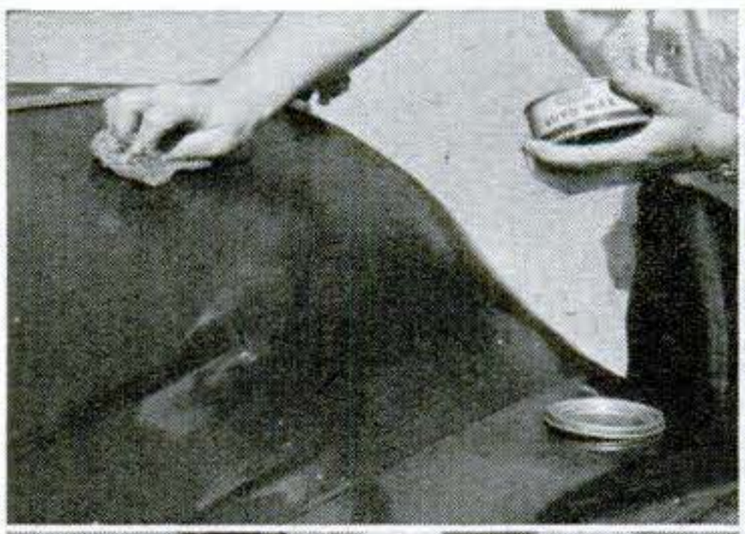
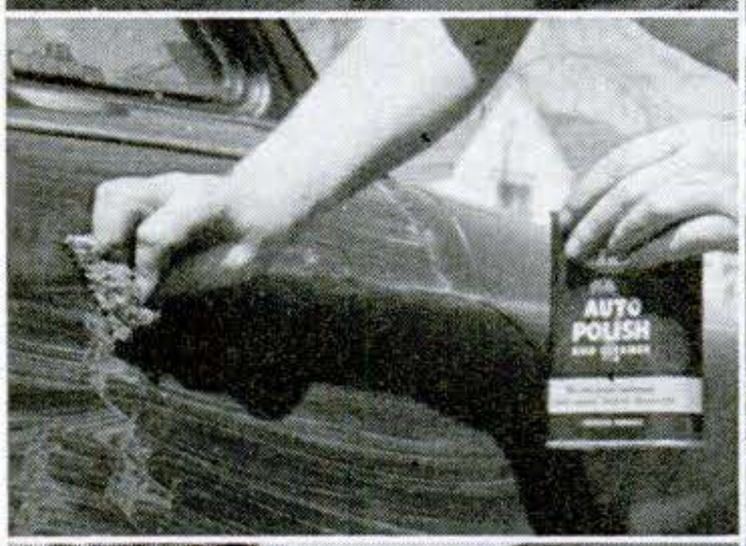
13. CLEANER IS WIPED OFF with soft cloth—an old undershirt is perfect, or an unsized material such as cheesecloth. On stubborn areas, you may have to apply cleaner two or three times. With slow-drying silicone cleaners, do whole car, then wipe; with others, work in small areas.

14. NICKED THE GARAGE DOOR? Don't worry, ordinary cleaner will remove most paint streaks; if not, use more highly abrasive rubbing compound, but apply it sparingly and wipe on gently so as not to wear away the paint. For taking off tar, asphalt, grease and other tough spots, use tar remover.



15. CHROME POLISH removes light rust and discoloration from bumpers and trim, but keep its abrasive action away from body paint. On heavy rust, use wire brush first. Where rust is beyond removal, you can hide it with chrome paint. Waxing after polishing will help protect chrome.





16. NOW COMES THE POLISH. Here you have a choice of three basic types shown at left above. If you don't mind elbow work, you can get a fine, durable finish with paste wax (at top). This is wiped on with a moist sponge, then buffed to a high sheen. Use two cloths, one to knock down thick excess and a second for polishing. Do small area at a time, and don't work in direct sun.

Combination cleaner-polishes (center) are good for quickie jobs, but may not last as long as a two-part cleaning and polishing job. Apply them like wax but more frequently—usually three or four times a year.

Easiest of all, thinks Red, is silicone polish (bottom). This is simply wiped on and off without heavy buffing. If polish is used every six or eight weeks, cleaning step need be done only every third or fourth time . . . Car looks pretty slick, doesn't it?

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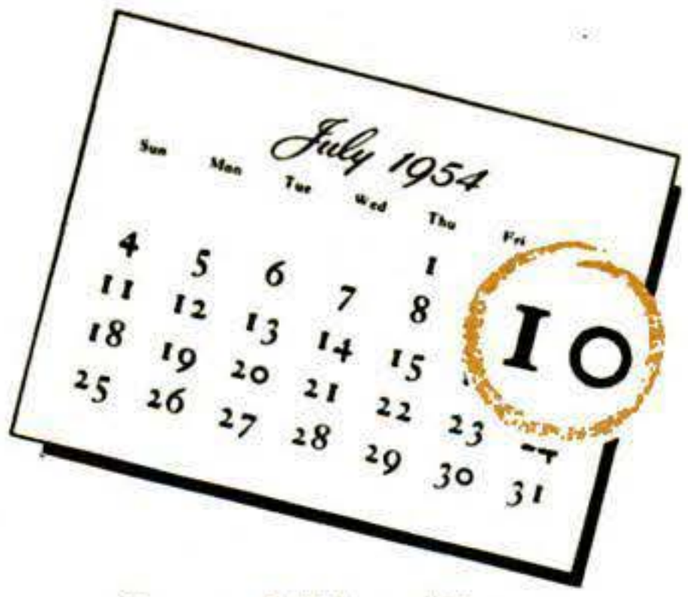
Knock Together a Beach Float



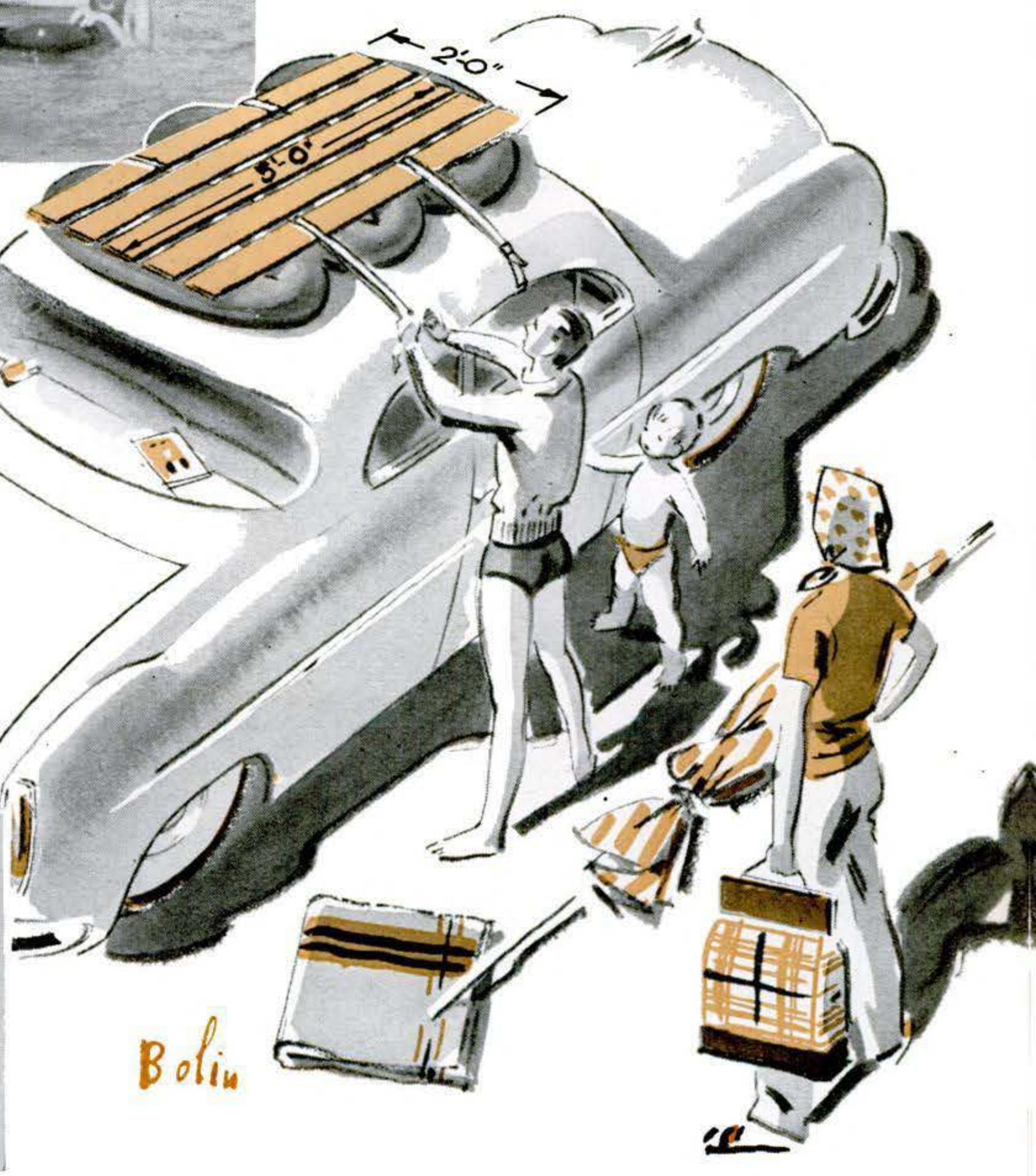
Three inner tubes on a wood frame will give the whole family lots of fun, make swimming safer.

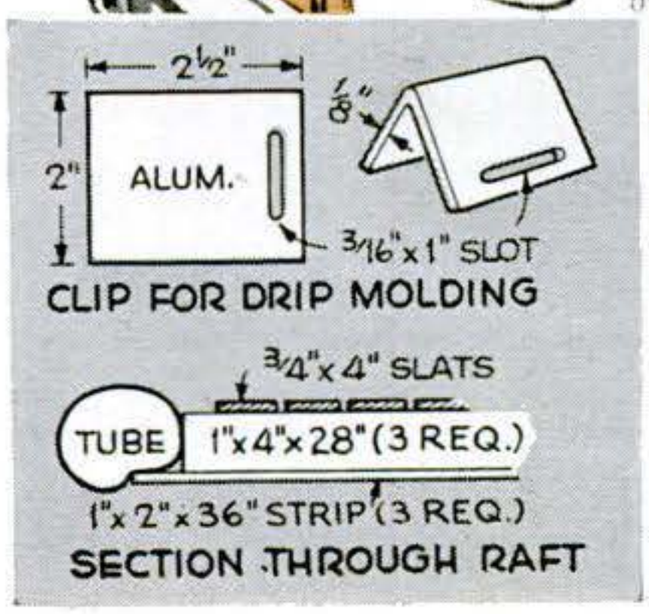
THIS light wooden raft fitted with three old inner tubes will easily float several children. It also serves as a car-top carrier for a small boat or beach equipment, providing more room inside the car for the trip to and from the beach. The inflated tubes keep the frame from scratching the car roof.

Make the deck from five smooth slats, ¾″ thick by 4″ wide and about 5′ long. Assemble them over three 1″-by-4″ crosspieces, about 2′ long. Screw 1″-by-2″ strips to the bottom edge of the crosspieces to form a T to hold the tubes.

Bend four clips from ⅛″ aluminum to grip the car's drip molding. Attach them to the float with 1″ web straps. Lash equipment on with long straps.—*S. Gennings, Port Colborne, Ontario.*

THREE INNER TUBES give triple safety. If one leaks or is punctured, other two will keep raft and kids afloat. Float should be anchored or tied to shore with clothesline or light manila rope to keep it from drifting beyond safe depth. All wood parts should be coated with spar varnish before assembling.





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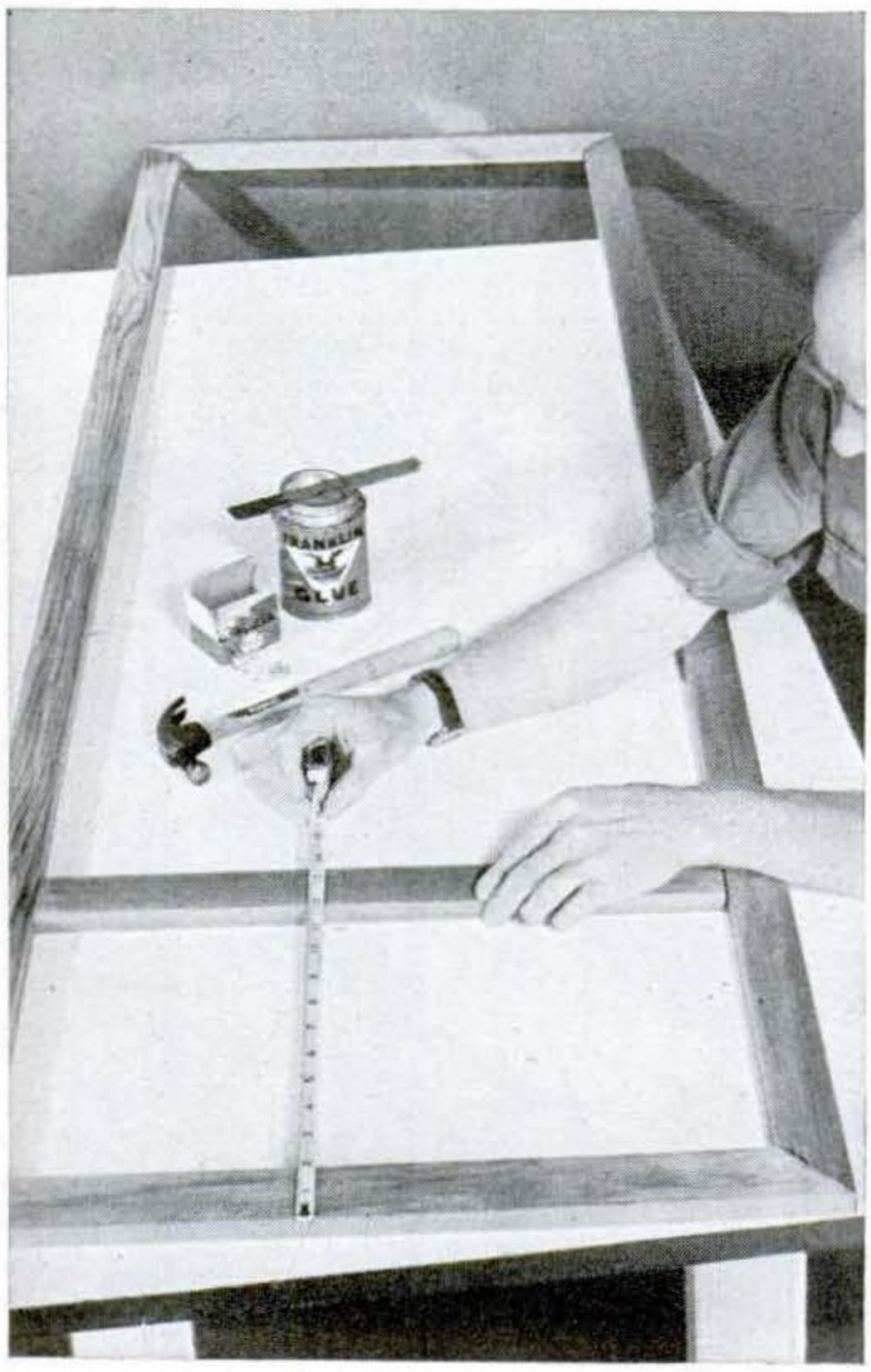
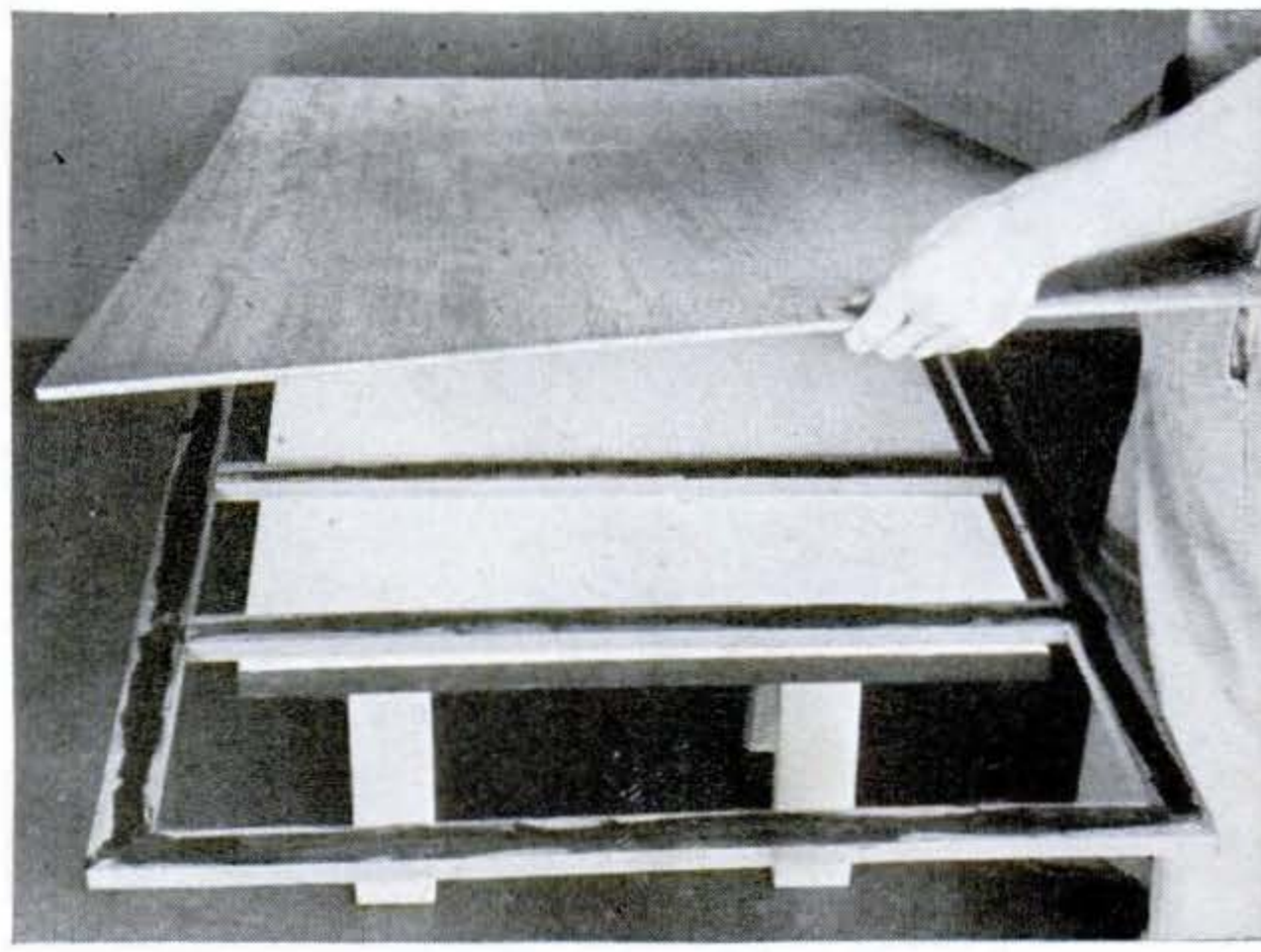
Prefab a Take-Apart Wardrobe for Your Home

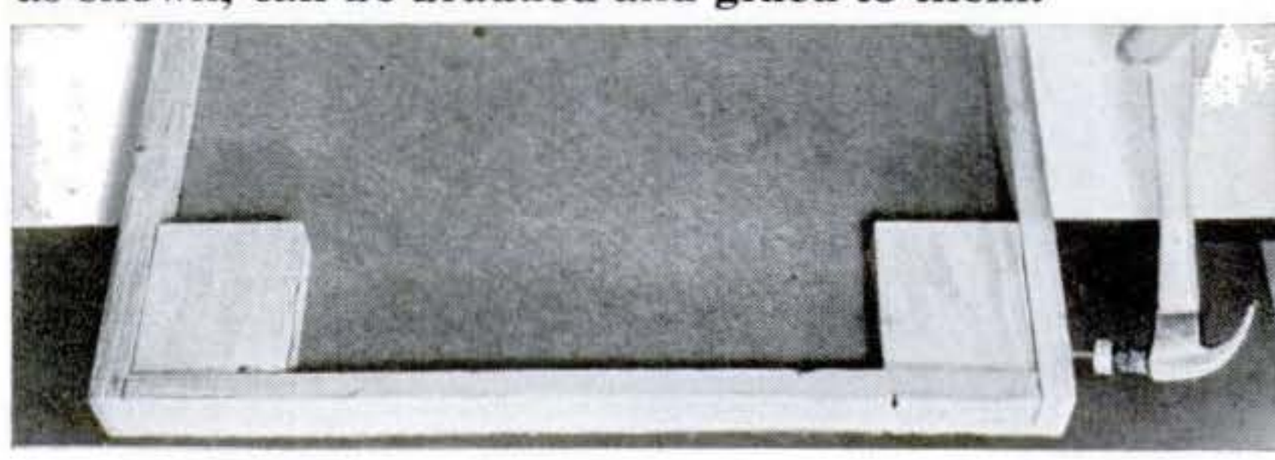
You can use it anywhere in the house—knock it apart for moving, or for storing away when it's not needed.



MAKE FRAMES for the seven panels by mitering the ends of the one-by-two pieces. Assemble with nails, glue and corrugated or chevron fasteners. Extra strip on 24″-by-72″ side frame, fastened 12″ from top, holds shelf.



GLUE AND BRAD covering material to one side of each panel. The 36″-by-72″ frame above serves for the back or door panel. Position crosspieces so the butting cover pieces, cut as shown, can be bradded and glued to them.



BOTTOM FRAME consists of one-by-twos glued and nailed together on edge. Cut the 16″ length of two-by-four into equal pieces and nail into the corners to support casters. Shelf is a 22¼″-by-36″ frame without blocks.

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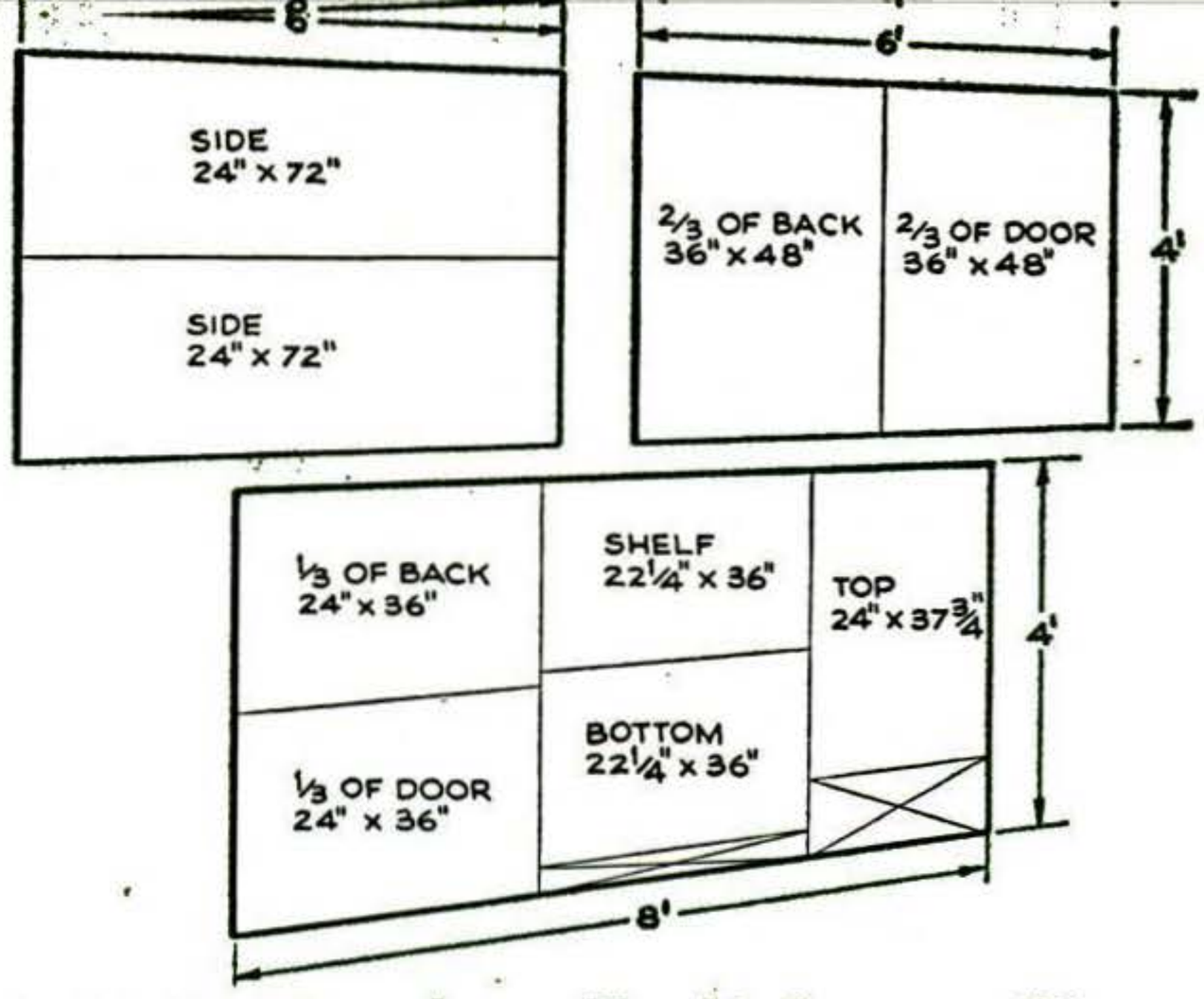
FOR day-to-day use, or for storage of summer and winter garments, this knock-down wardrobe will ease the strain on limited closet space. It can be set up in a guest room, game room, attic or basement, or taken apart quickly and stowed compactly when not in use.

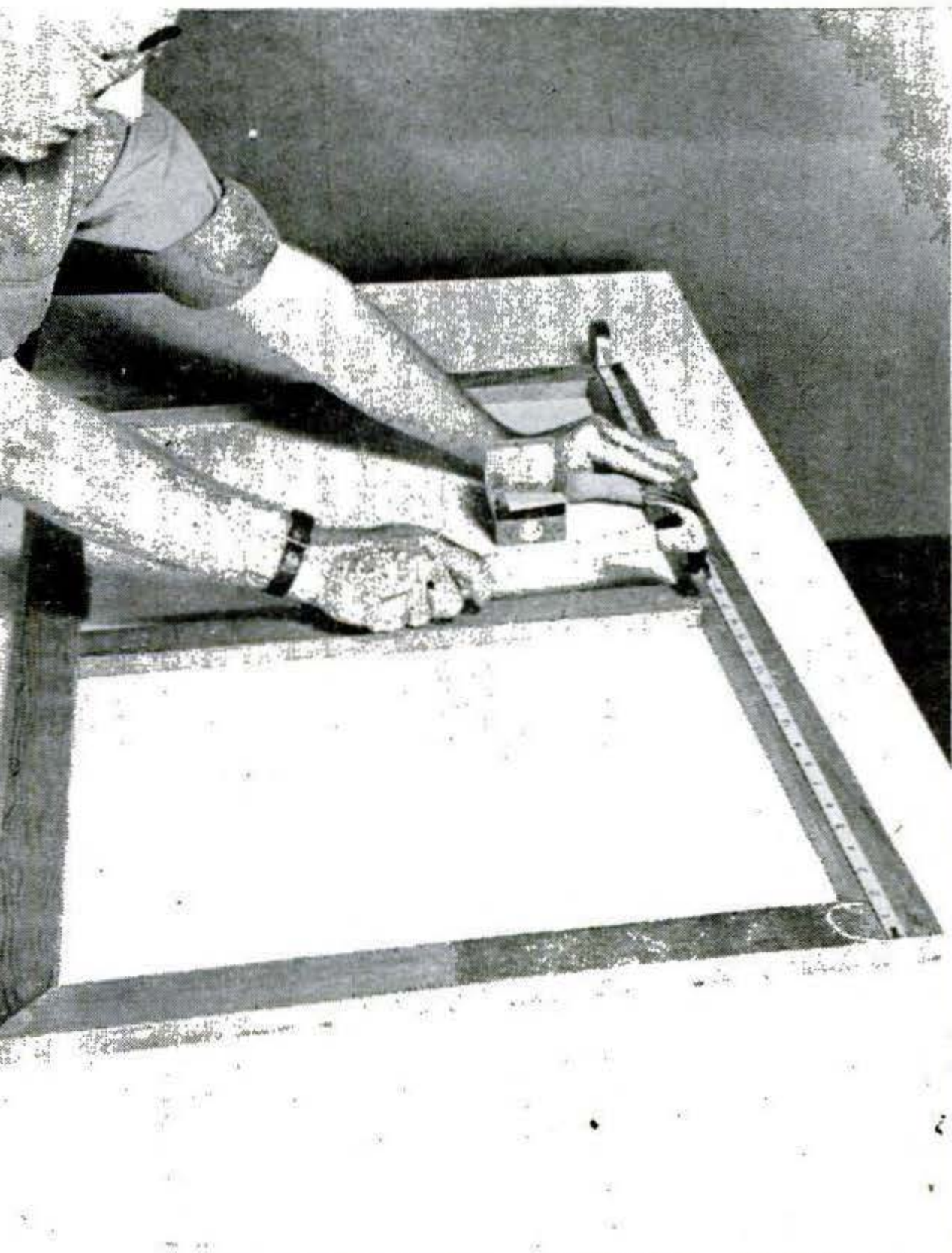
The wardrobe consists of six separate panels joined by wood screws, and a seventh panel fitted with loose-pin hinges for the door. Cut the panel from sheets of hardboard or plywood and assemble them on one-by-two frames. Enamel the wardrobe to suit its location, or, for a neater job, use a plastic-surfaced plywood protected by a coat of clear lacquer. *—Paul Corey, Sonoma, Calif.*



PANEL COVERS can be cut like this from two 4′-by-6′ sheets and one 4′-by-8′ sheet of ⅛″ tempered hardboard or ¼″ plywood. Other material you'll need includes:

12′ of 1″-by-2″ stock, 16′ of 2″-by-4″ stock, 1 closet pole 36″ long.

You'll also need a pair of loose-pin hinges, 4 1⅛″ chest casters, 5 doz. #8 1½″ roundhead screws, 3 #10 3″ screws, 4 doz. 6-penny finishing nails, ½″ corrugated or chevron fasteners, ¾″ brads, a pint of liquid hide glue.



WARDROBE TOP is made 24″ by 37¾″. This allows it to overlap the ends of the sides and back and project over the door. Miter the ends and glue up the frame. Use fasteners to attach the center brace, too.

ASSEMBLE PANELS with roundhead screws. Fasten pole to underside of shelf with 3″ screws: hang door on loose-pin hinges and attach pull. Wardrobe can be taken apart by lifting off door and removing screws.

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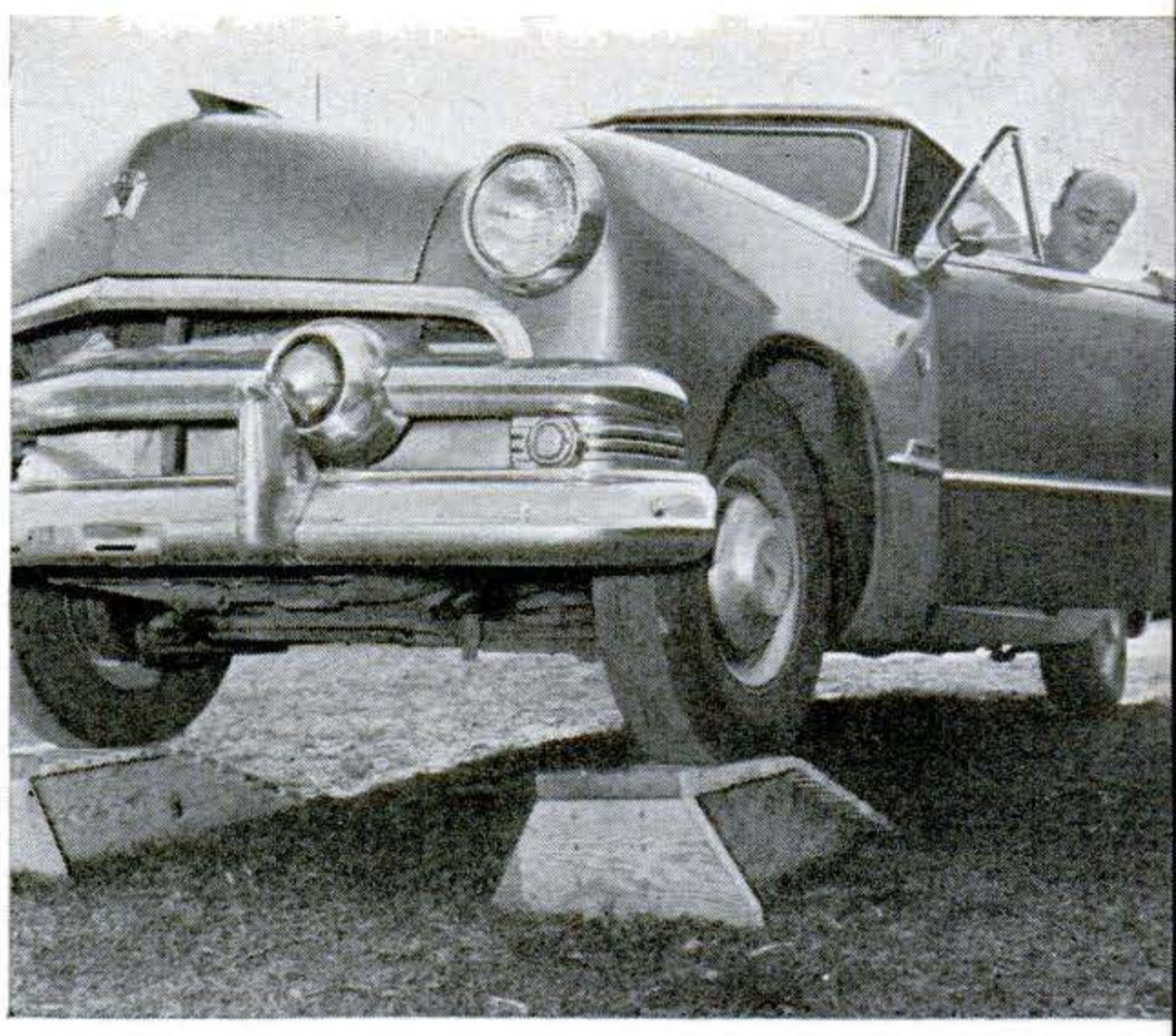
Build a Pair of Car Ramps

These handy elevators will give you more room for under-car jobs. Materials cost about $3.

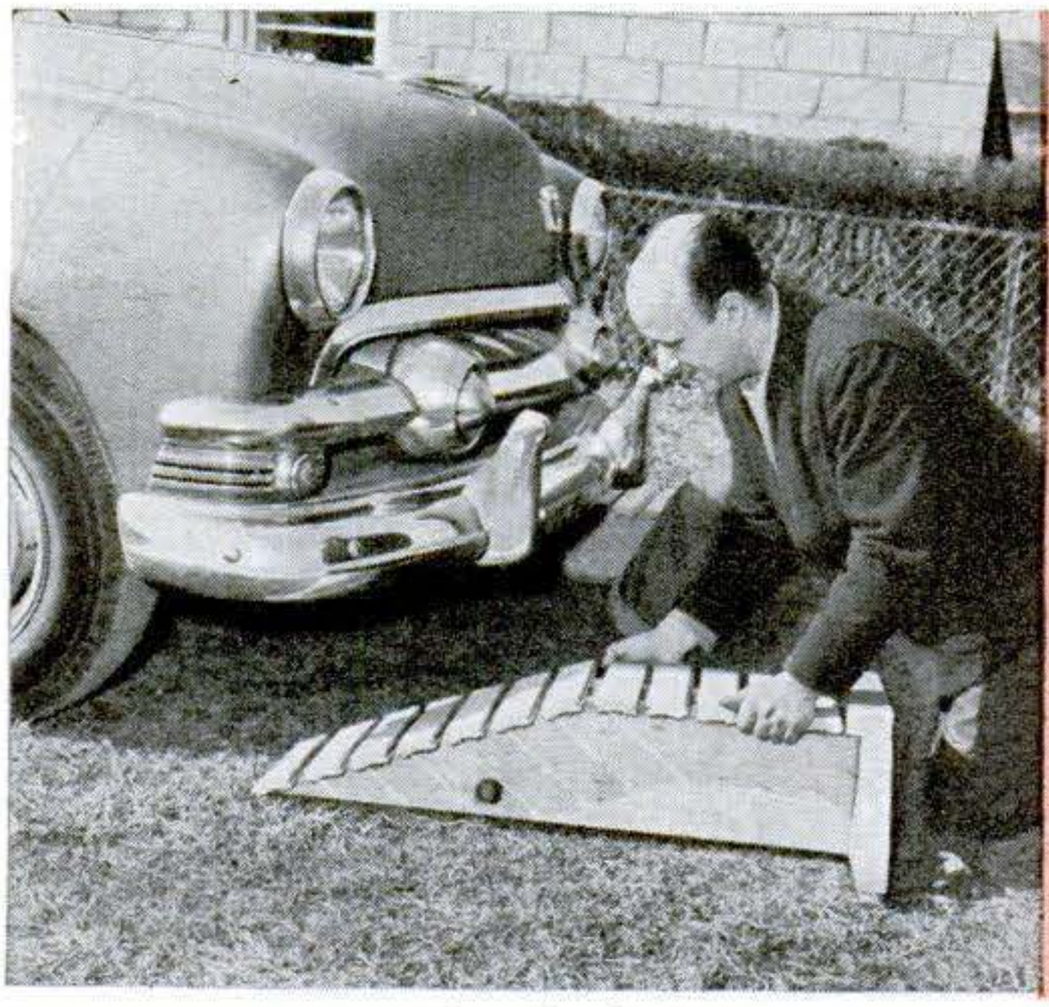


IF LACK of headroom is keeping you from maintaining your car or making simple repairs or adjustments on its underside, run it up on a pair of these husky ramps. They'll raise the car about 9″, giving ample room to move around—even room to swing a grease gun on fittings that point straight down.

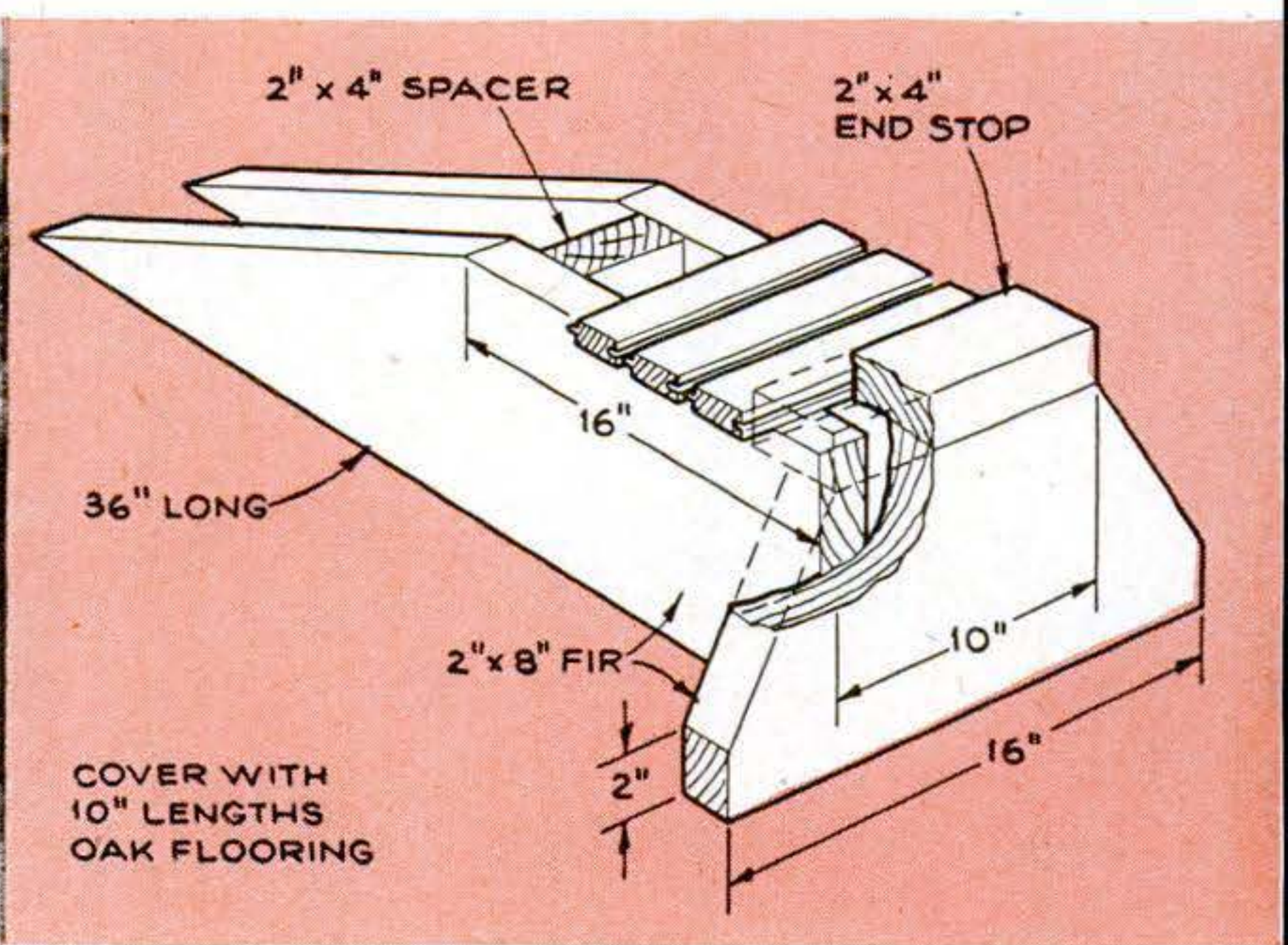
A bundle of short lengths of oak flooring and a 12′ length of two-by-eight provide enough material for two ramps at a cost of slightly more than $3.

Lay out the sides on the piece of two-by-eight so that one diagonal cut will produce two sloping surfaces. This way, you'll save cutting as well as lumber. Clamp the sides in pairs and plane them smooth. Cut the two end pieces from the remaining two-by-eight. Stand the sides on edge, about 3½″ apart, and nail the end pieces to them. Nail a 2″-by-4″ spacer on edge between them at a point just before they start tapering.

Cut the oak flooring into 24 pieces, 10″ long, and nail them across the body. Space them out evenly so that there are five slats on the level part and seven on the slope. Nail a 10″ length of two-by-four across the end of each ramp. This will prevent the car from rolling over and off them.—*Herb Pfister.*



PLACE THE RAMPS ahead of the front wheels, sighting back to the rear wheels to line them up. If the repair job is at the rear of the car, back it up on the ramps.



WIDE END PIECES make ramps tip-proof, let you turn the wheels from side to side for access to grease fittings on kingpins and steering-arm ends. Block at end stops car.

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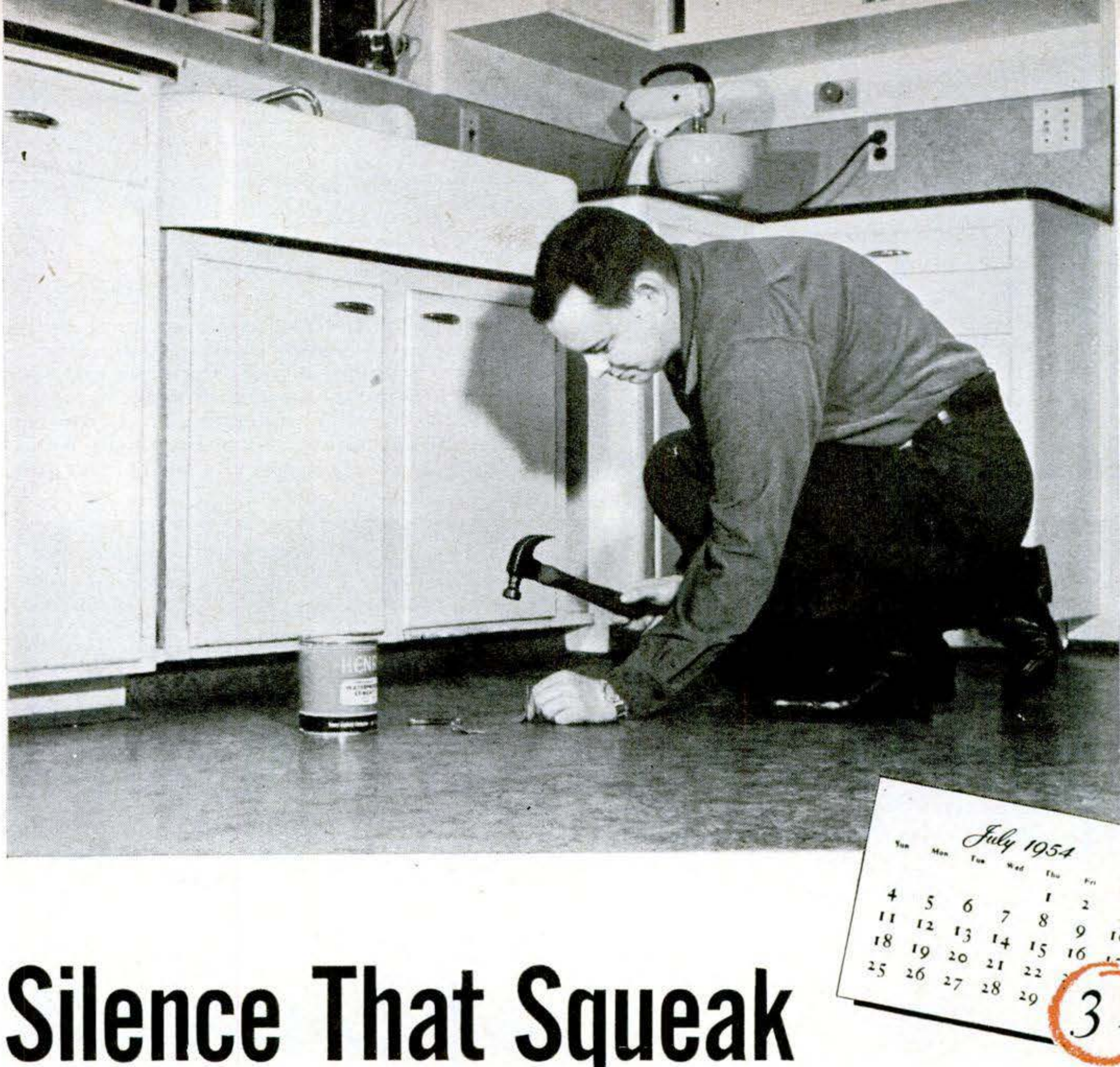

Silence That Squeak in Your Kitchen Floor

Why put up with noisy gremlins underfoot, when you can easily drive them out without removing or damaging the floor cover?

THE other day I stopped at a floor-covering store to ask how to get rid of squeaks in my kitchen floor. Every time you stepped on some spots, the noise was enough to rattle your eyeteeth.

He could fix that, the man said. First he'd rip up the old linoleum. Then he would renail the subflooring and the underlayment solidly to the joists. That would stop the squeaks, and what kind of new covering did I want—linoleum, or asphalt, rubber, cork or vinyl tile?

Clutching my wallet hard, I got out before he could snatch up a sample.

Since I couldn't cough up for a new floor, it seemed we would have to learn to live with a noisy one. It was worst in front of the sink. For the sake of my nerves, I told my wife that I ought to make it a point never to wash the dishes.

This solution did not appeal to her, and that night, before I got to the cups, I knew the squeaks had to go.

The basement runs underneath our kitchen. So first I went downstairs and—but I'll let the pictures take it from there. The job didn't take long, and there isn't even a mouse-sized squeak left. For how I did the job, please turn the page.—*John Burroughs, Tacoma, Wash.*

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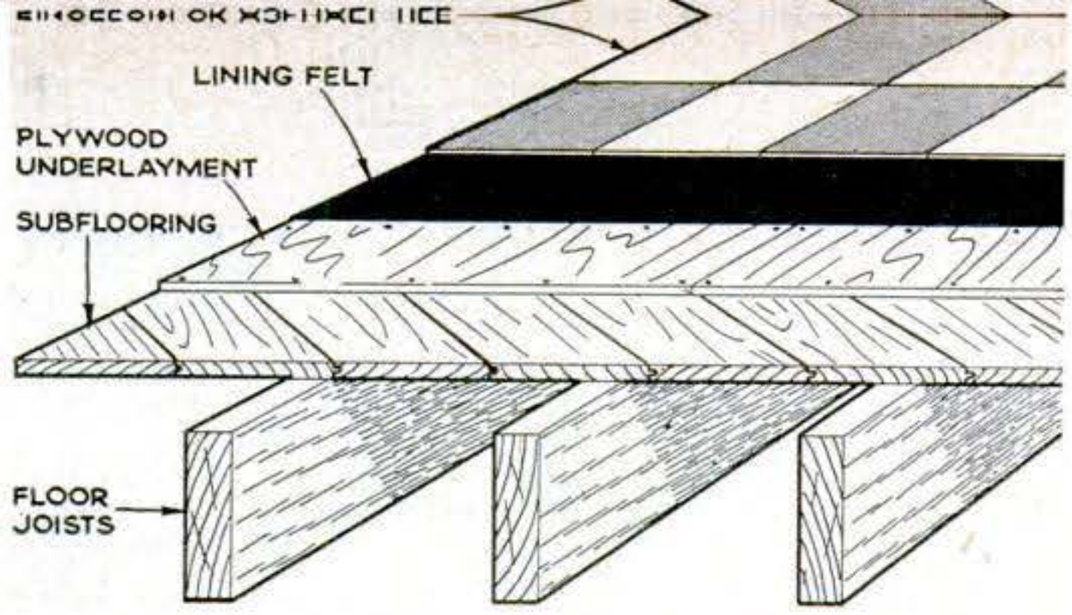
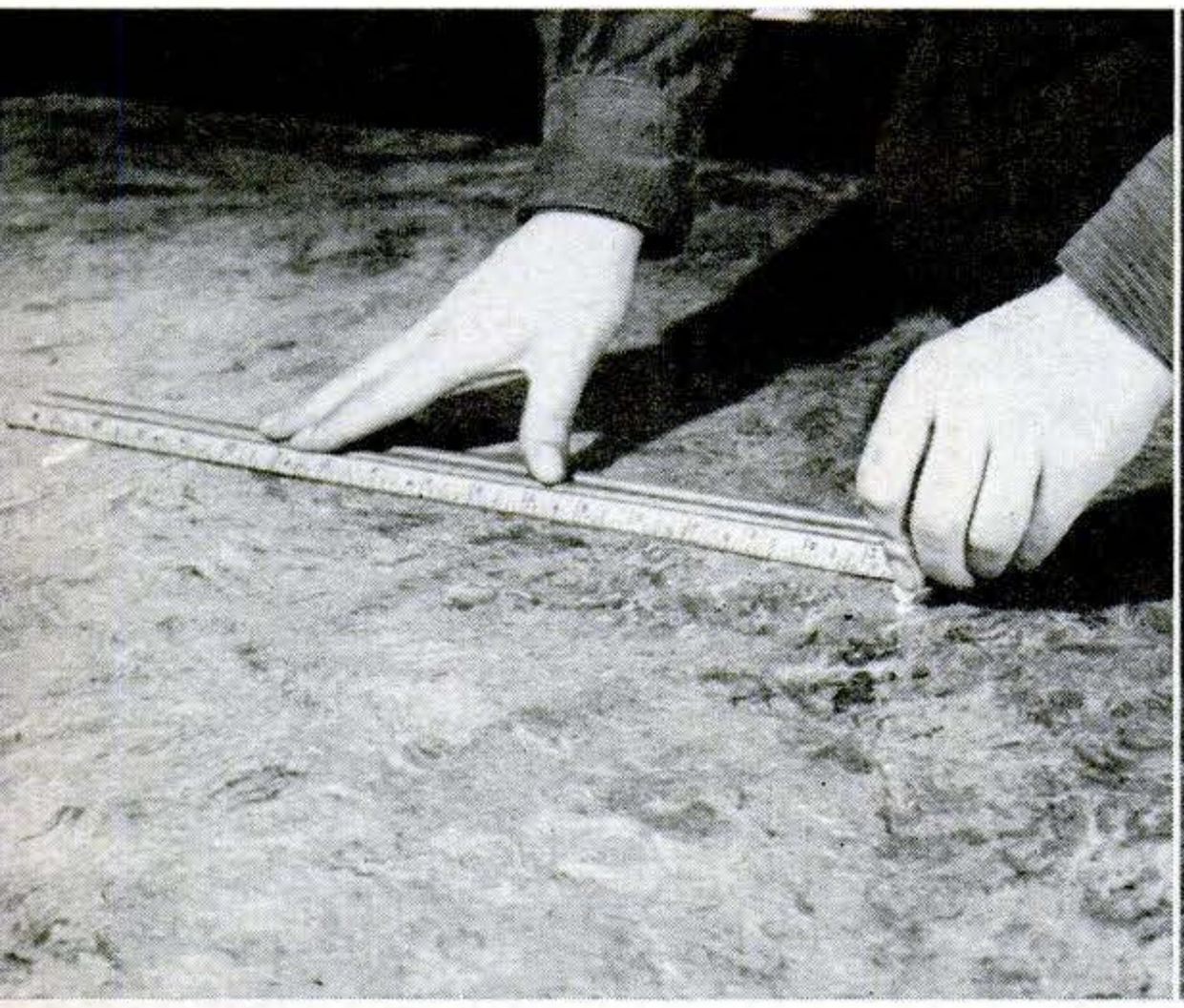


THE PARTS OF A FLOOR are diagramed above. In a kitchen, moisture may warp the underlayment. Bulging, it pulls the nails up, your weight presses it down, and squeaks occur. If there is a cellar under the floor, you can check the subflooring by trying to slip a putty knife between it and the joist, as at left.

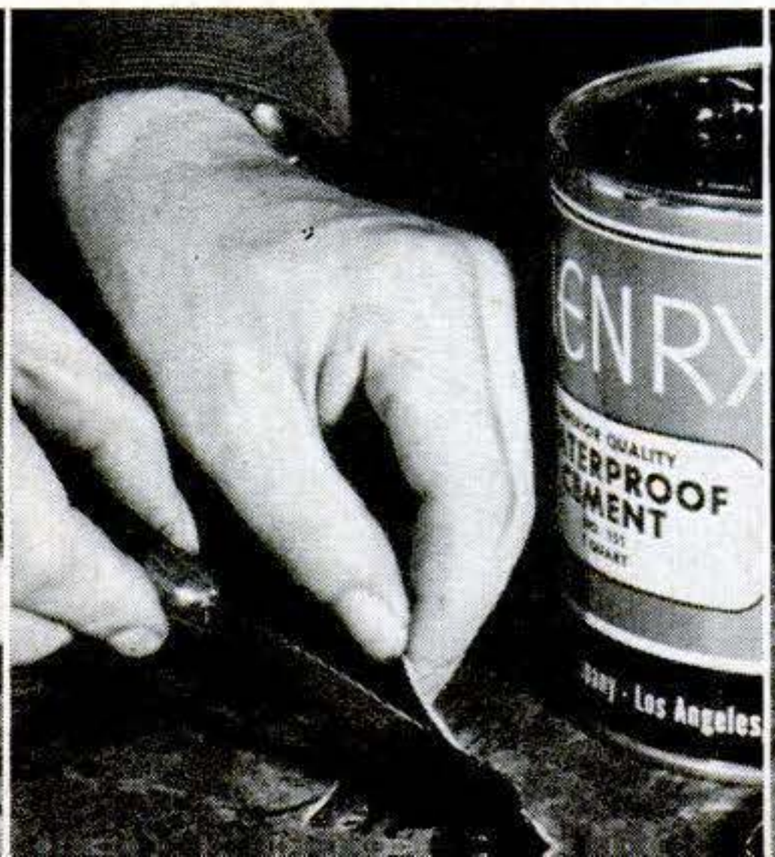


AFTER LOCATING A SQUEAK, chalk the spots where the floor joists come. To do this, measure in the cellar from one joist to a water or steam pipe that goes up through the floor. Then you can measure from the same pipe over the linoleum. Joists usually are 18" apart. Chalk all the joists near the squeak.

AS NEAR THE CENTER of the noisy floor area as possible, cut a corner flap in the floor covering directly over a joist. Use a sharp knife. Gently lift the flap, being careful not to break it off. Cutting along a streak or square in the linoleum pattern will help considerably in hiding this necessary surgery.

WITH A 9/64" DRILL, make a pilot hole through the plywood underlayment and subfloor into the joist beneath. Drive in a 1½" No. 6 wood screw until the head is sunk flush. If the pilot hole is the right size and the joist beneath is sound, countersinking the screw probably will not be necessary. Other fastenings you can use include spiral-shank, ring-barbed or cement-coated nails.

BLOW OUT THE CHIPS. Then coat the underside of the flap liberally with asphalt-base linoleum cement, press flap back, and iron it down with a putty-knife handle or other blunt object. Clean off excess with a rag moistened in solvent. Weight the patch until cement dries. One screw may quiet an area several feet across; if more are needed, bear outward from center, using one at a time.



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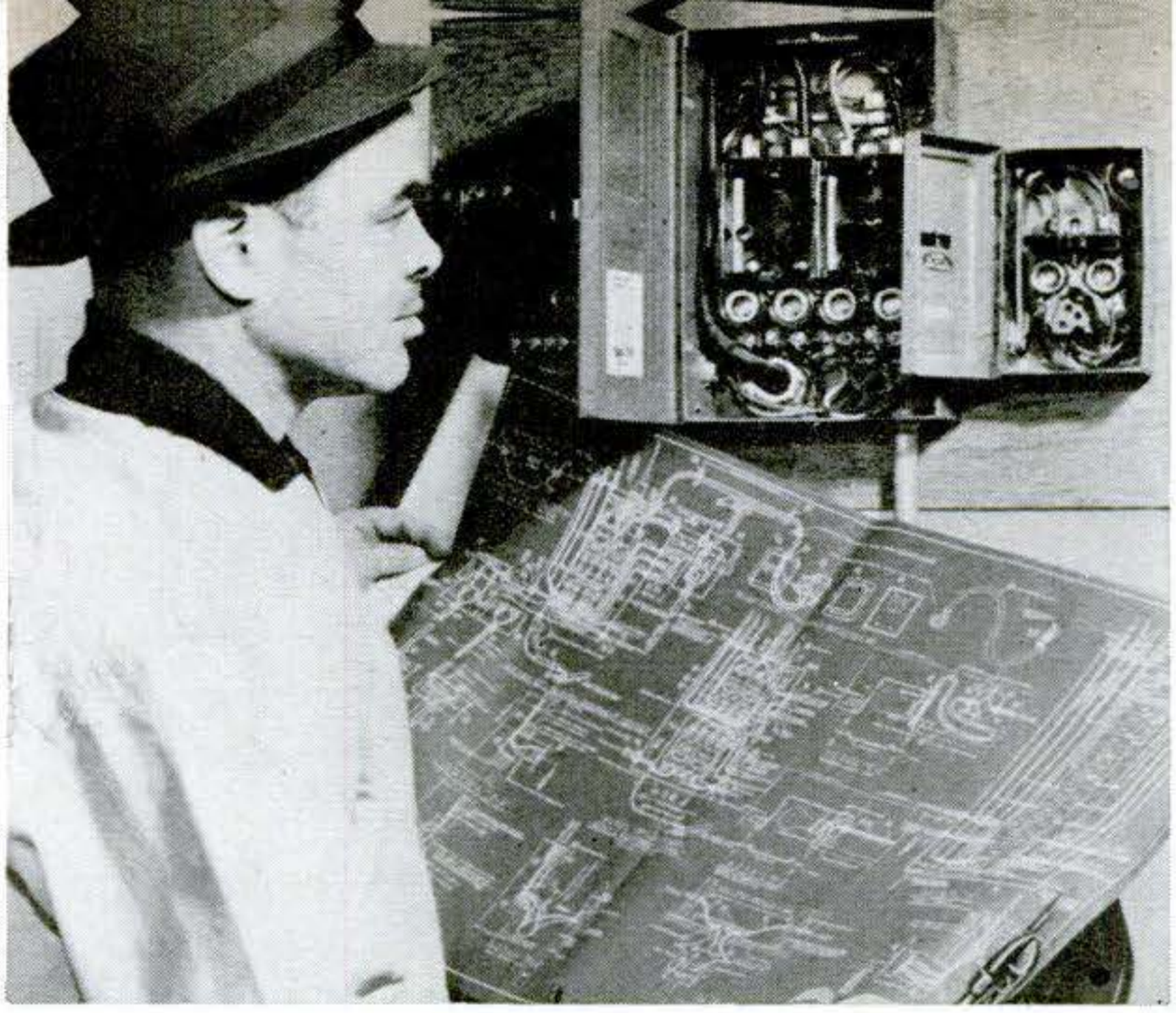
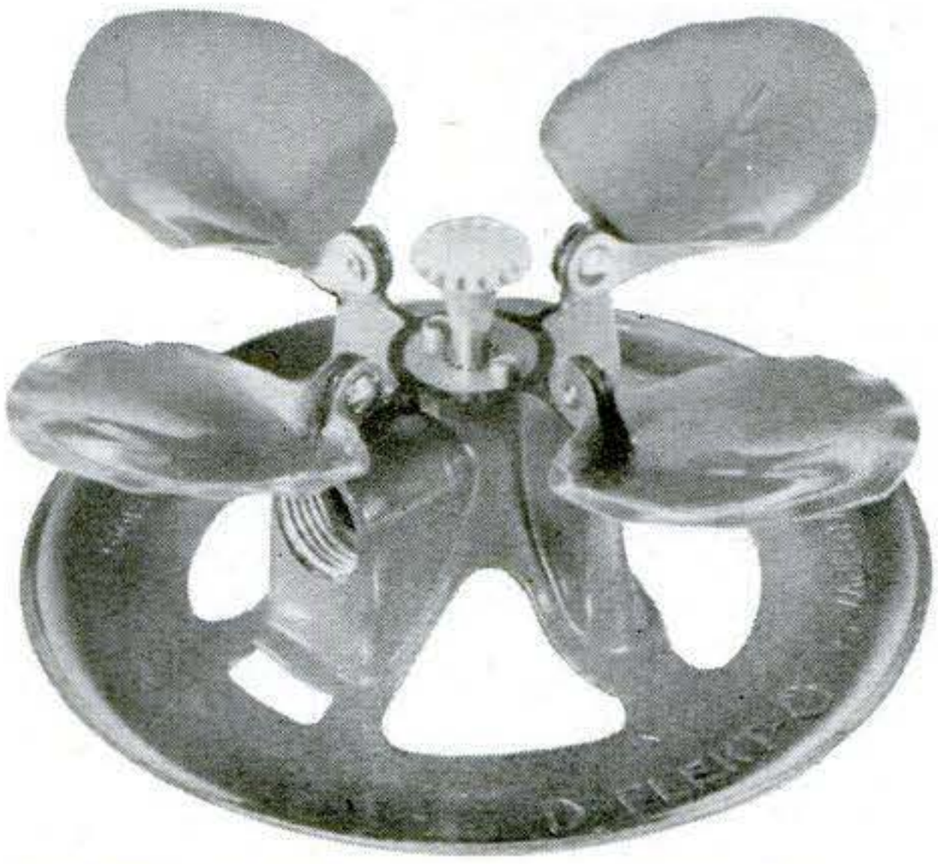
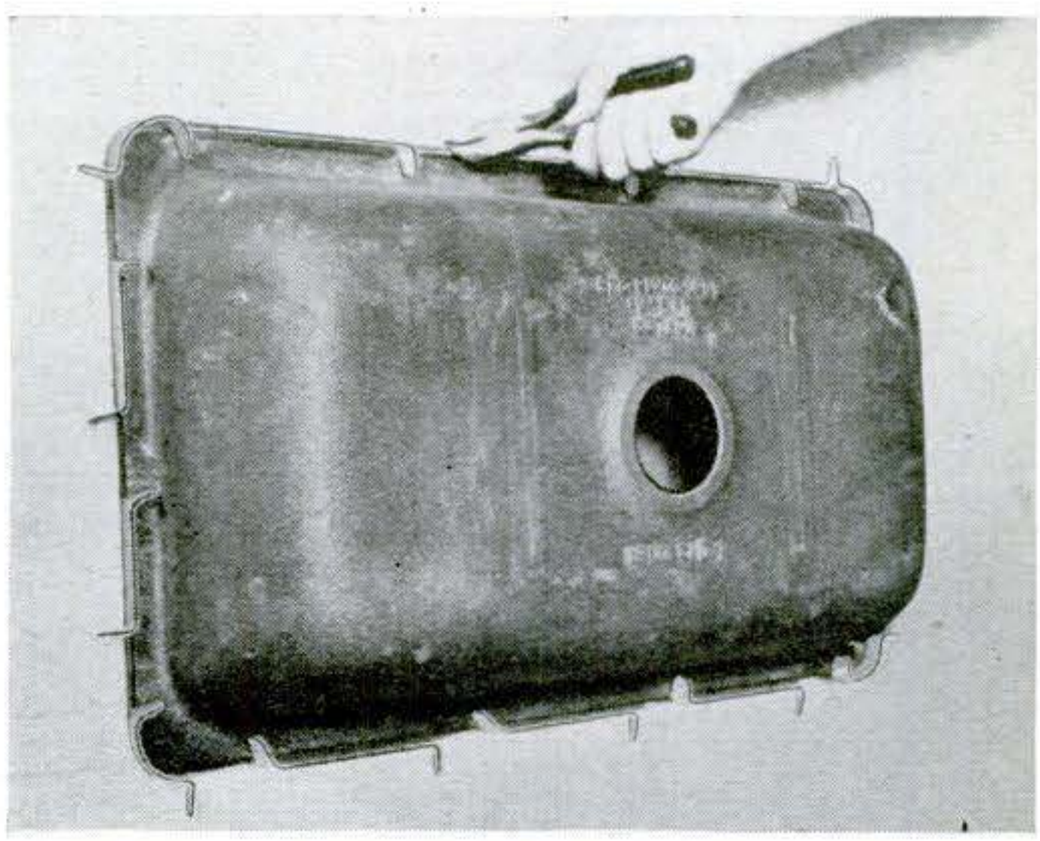


New for the Handy Man

1. Plans Show Home Wiring. You can do all of your own home wiring with this set of plans. The three 18″-by-29″ blueprints show typical installations for lighting fixtures, wall outlets—even electric ranges, driers and fuse boxes. All parts needed are described on an accompanying sheet so that you can tell exactly what to buy.



2. Sprinkler Sprays Anywhere. You can put water just where you want it with this lawn sprinkler by the way you tilt the four hinged deflectors. With all deflectors flat, you get a full 30′ circle; with one tilted up, a half-circle; and with two up, a quarter-circle. By changing the angle of tilt you can also vary the area covered.



3. Frame Mounts Sink Quickly. Kitchen sinks can be installed in a few minutes, using only pliers, with this special frame. Metal tabs around the edge are simply bent one way to lock the frame to the counter and the other way to lock the sink to the frame. Being tapered, the tabs allow for varying thicknesses and wedge tightly on.

4. Garden Cart Does Many Jobs. This wheeled cart makes a useful hand truck for hauling up to 200-pound loads. With a hook-on canvas bag, it's handy for toting laundry or collecting leaves and trash. The cart collapses for storage.

Please turn the page for more handy-man news.

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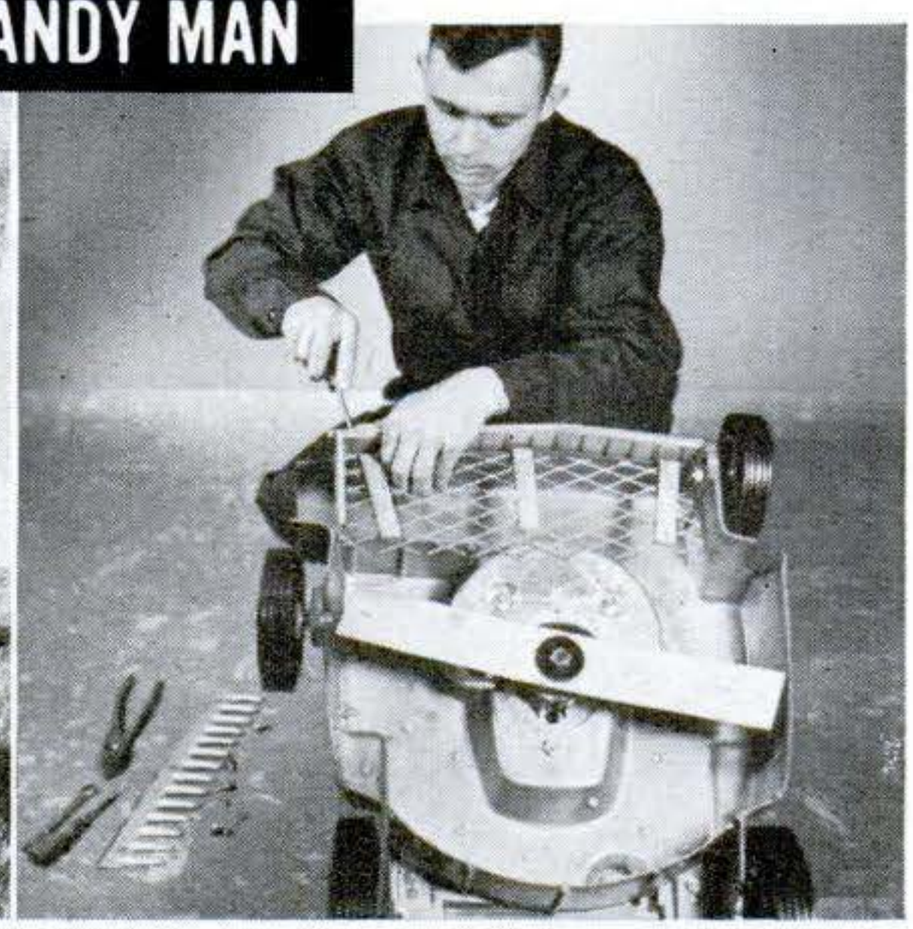
MORE NEWS FOR THE HANDY MAN



5. Mower Gets Mulcher. A metal grid, quickly attached to this rotary power mower, shreds leaves and grass cuttings into fine particles that need not be raked up after mowing. The staggered wheel arrangement keeps blade from digging in on uneven terrain, permits cutting to within ⅜″ of obstructions, saving trimming.

6. Can Disposes of Garbage. Essentially a bottomless garbage can, this container not only holds food waste but disposes of it as fast as you put it in. The can is sunk in an 18″ pit, where a chemical action liquefies bones, eggshells and other food, carrying the waste safely away below ground. A small amount of chemical starts the action, and from then on the disposer will work five to 10 years without attention.

7. Bracket Speeds Ladder Work. This tubular-steel bracket clamps quickly to the top of a ladder, holding it away from the house for easier painting of eaves or handling of storm windows and screens. It adjusts to any ladder angle and can also be hooked over the roof, providing handrails for safer climbing up and over the edge.

Further information on the products shown on this and the preceding page can be obtained from: 1. Home Building Plan Service, 2454 N.E. Sandy Blvd., Portland, Ore.; 2. Majestic Mfg. Co., 4550 Gustine Ave., St. Louis 16, Mo.; 3. Macklanburg-Duncan Co., Box 1197, Oklahoma City, Okla.; 4. Canvas & Metal Specialties, Inc., Groveville, N.J.; 5. RPM Mfg. Co., Lamar, Mo.; 6. Bardmatic Corp., Muskegon, Mich.; 7. Clayton Mark & Co., 1900 Dempster St., Evanston, Ill.

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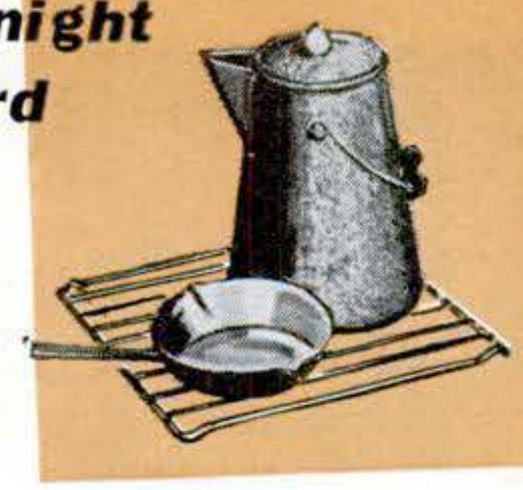
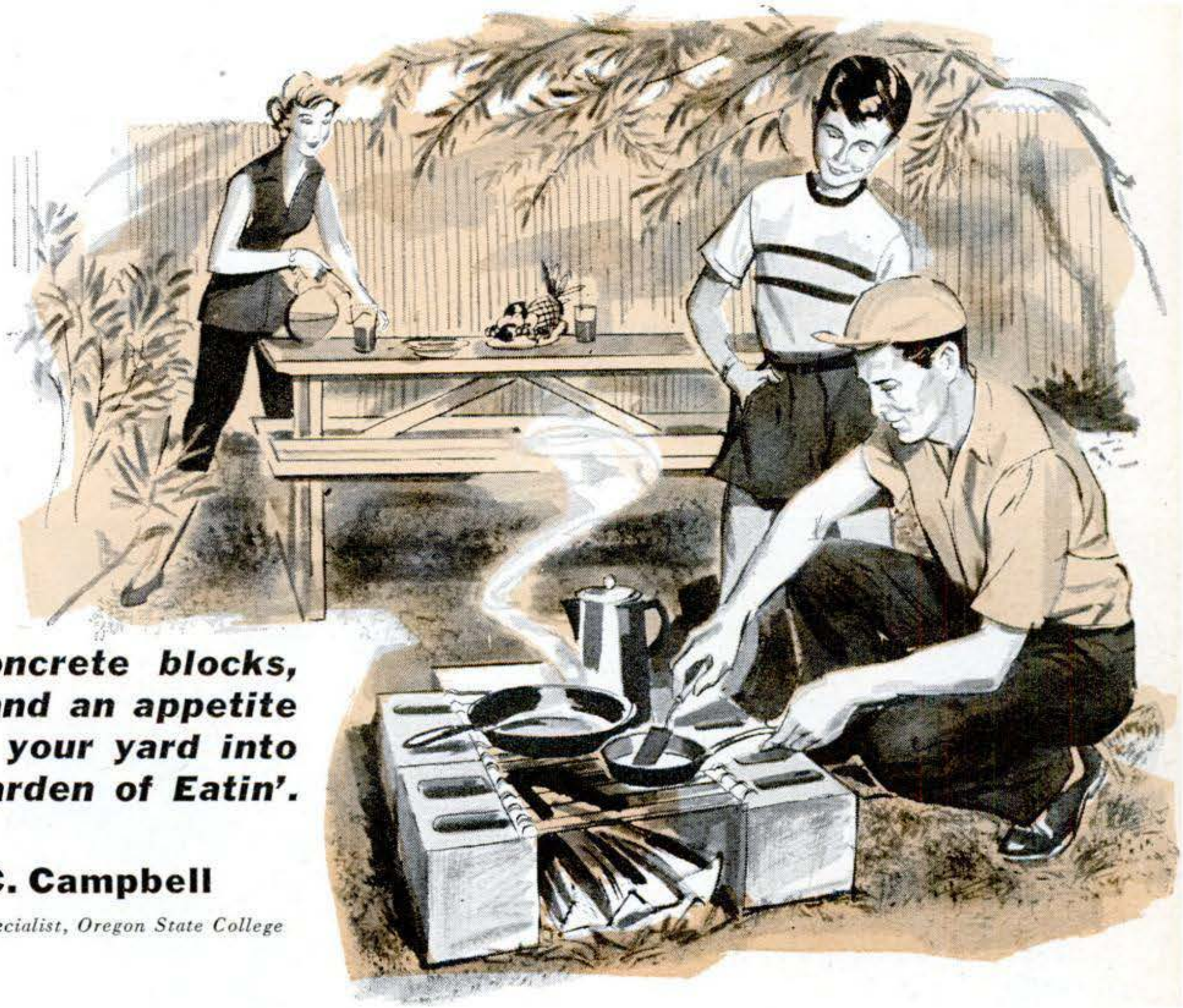
You can dine out tonight in your own back yard



Quickie Fireplaces for Outdoor Cooking



Three concrete blocks, a grate and an appetite can turn your yard into a real Garden of Eatin'.

By John C. Campbell

Rural Housing Specialist, Oregon State College

IN CASE you get a yen for charcoal-broiled steak at five some afternoon, you can have just that for dinner provided you rush out and buy (1) the steak, (2) three standard concrete blocks costing a total of about a dollar, (3) a grate from an old kitchen range or refrigerator, (4) a bag of charcoal if you have none on hand.

The fire will take you longer to build than the fireplace. Just lay the three blocks, put the grate across them, and—yum! what's cooking?

No fooling. It really is that easy. Probably nothing you can add to your back yard will provide more get-together-at-home pleasure than an outdoor fireplace. A supper in the back yard rounds out a full and happy day when you're back from work or from the beach. Friends are easy to entertain in the informal atmosphere of the outdoors.

If you've thought that building an outdoor fireplace is too much work, or costs too much, consider what you can do with concrete blocks. Not only the three-block quickie already mentioned, but more elaborate permanent units can be built in less than half the time a brick or stone unit would require. Keep it simple and you'll be having fun before you think it's work. For other ideas on outdoor dining, see the next five pages.

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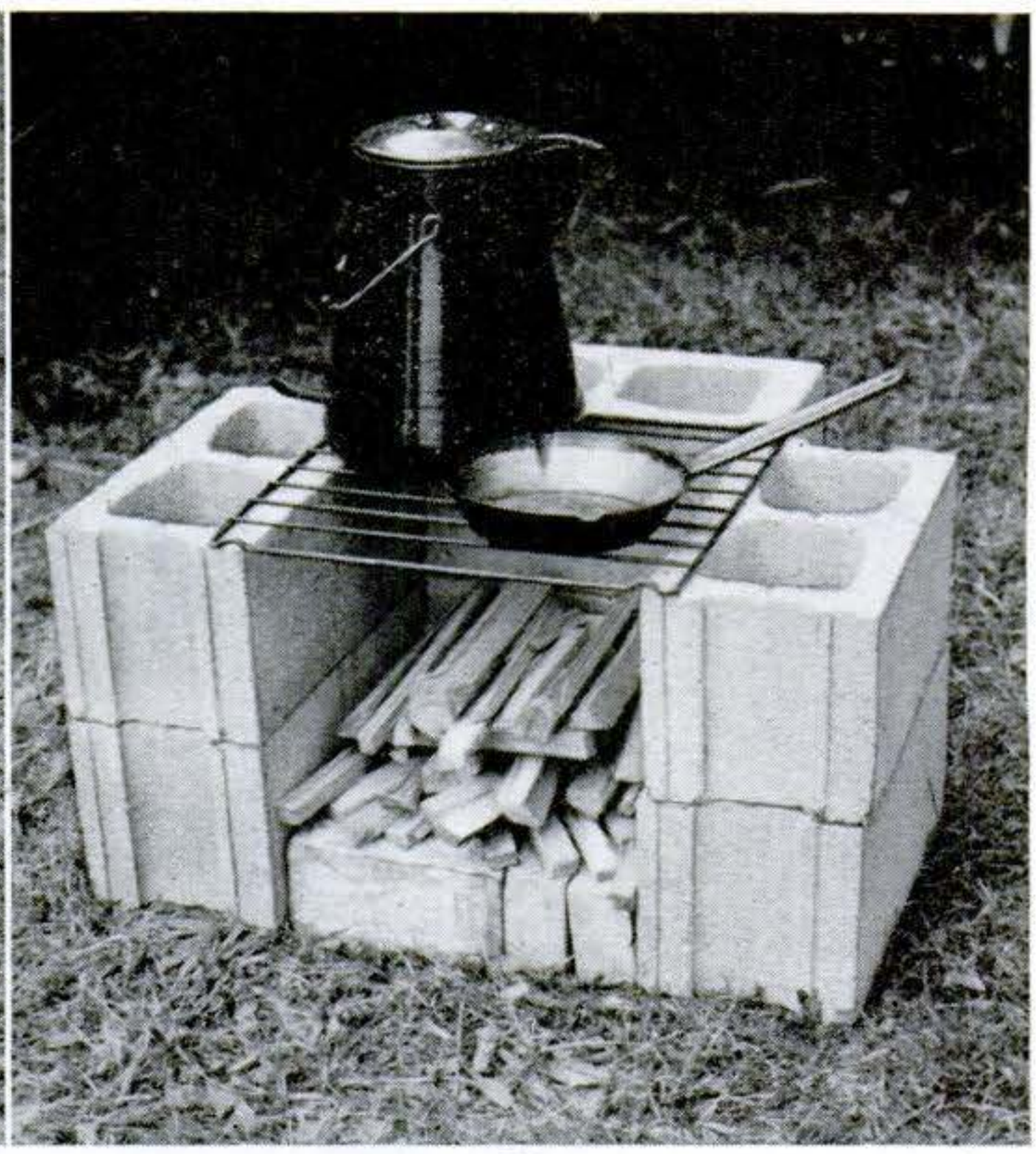
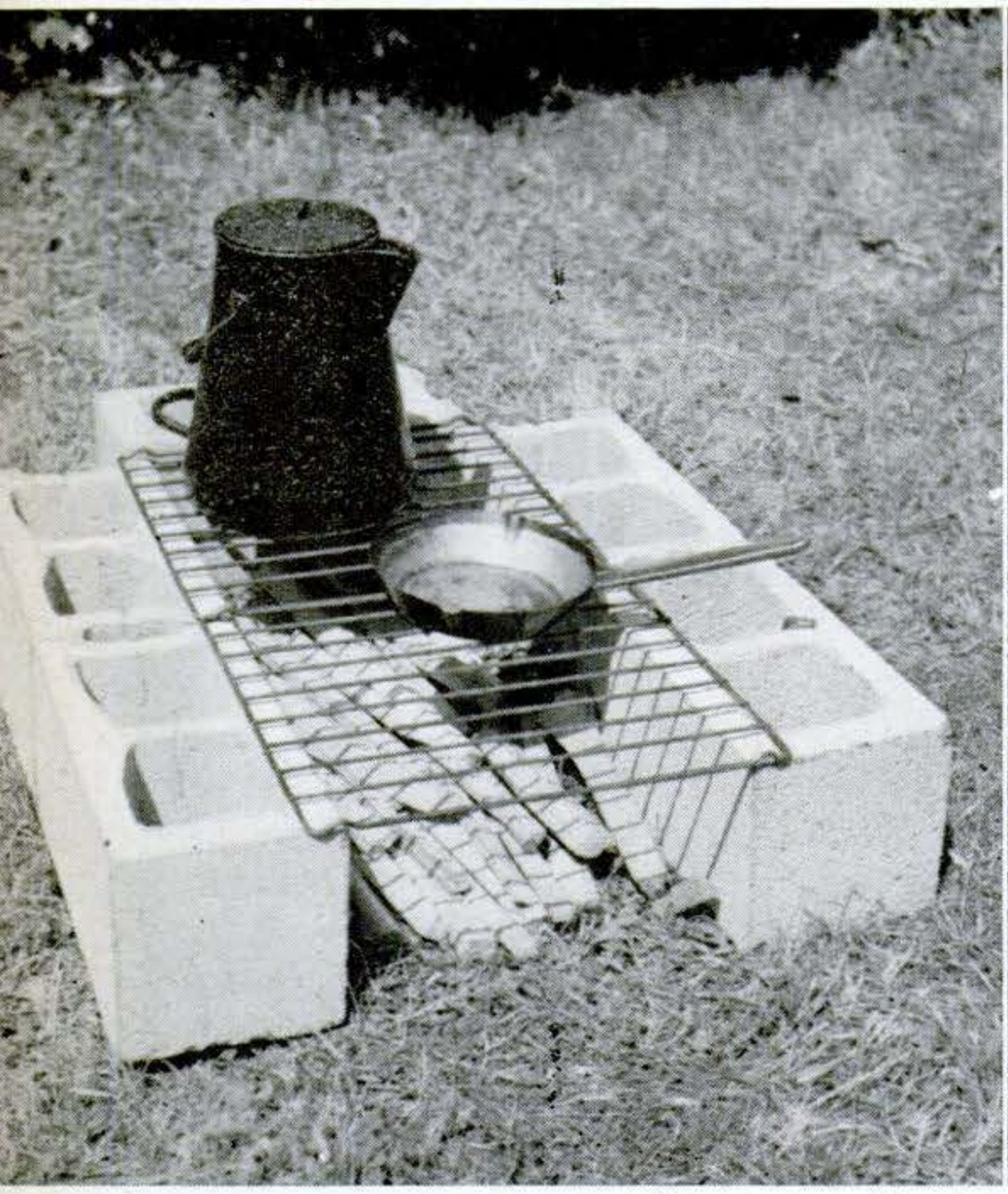
QUICKIE FIREPLACE consists of three 8-by-8-by-16 concrete blocks with a grate salvaged from an old oven or refrigerator laid across them. It provides a firebox closed on three sides to conserve heat, it can be faced into the wind for draft, and the cooking surface is near the fire to make best use of the heat.



STIFF-KNEED CHEFS will appreciate a somewhat higher fireplace. A second row of blocks brings the grate to a more convenient height. The fire is built on a floor of ordinary brick to keep it within 12″ of the grate. Blocks are set up without mortar, making the fireplace easy to disassemble.



KING SIZE OR LONG JOHN gives you a bigger cooking surface. If guests drop in, just add two more blocks and a second grate. There's plenty of room here to cook as fast as they can eat. Lacking charcoal, wood will give a hot fire, but may send up more smoke.

ADD A CHIMNEY for more draft and better smoke control. This is only practical with the two-block-per-side fireplace, as a single block does not provide enough depth. The back is closed in with a fifth block and chimney blocks are stacked in front of it.

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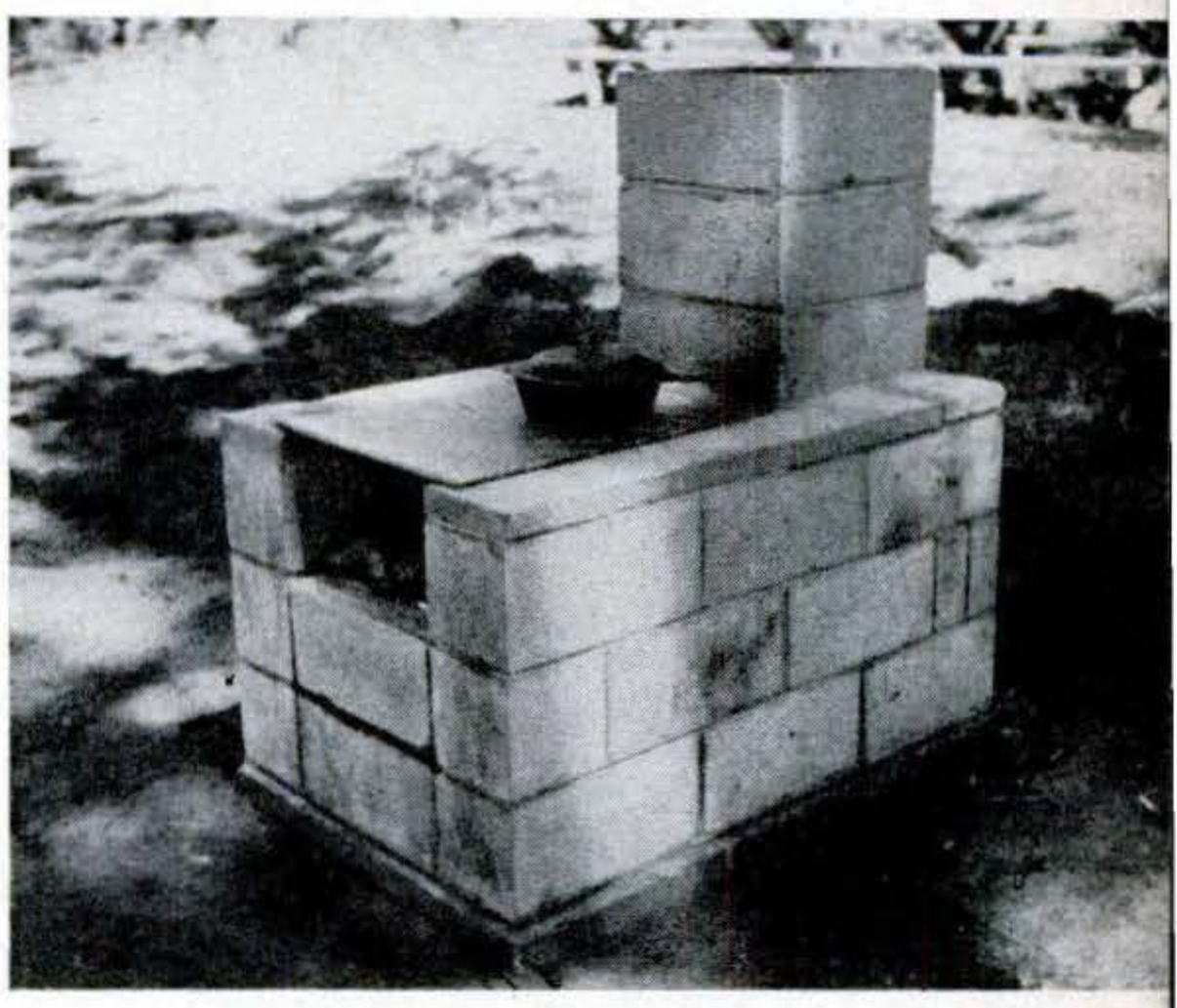
Use Blocks for a Permanent Fireplace, Too

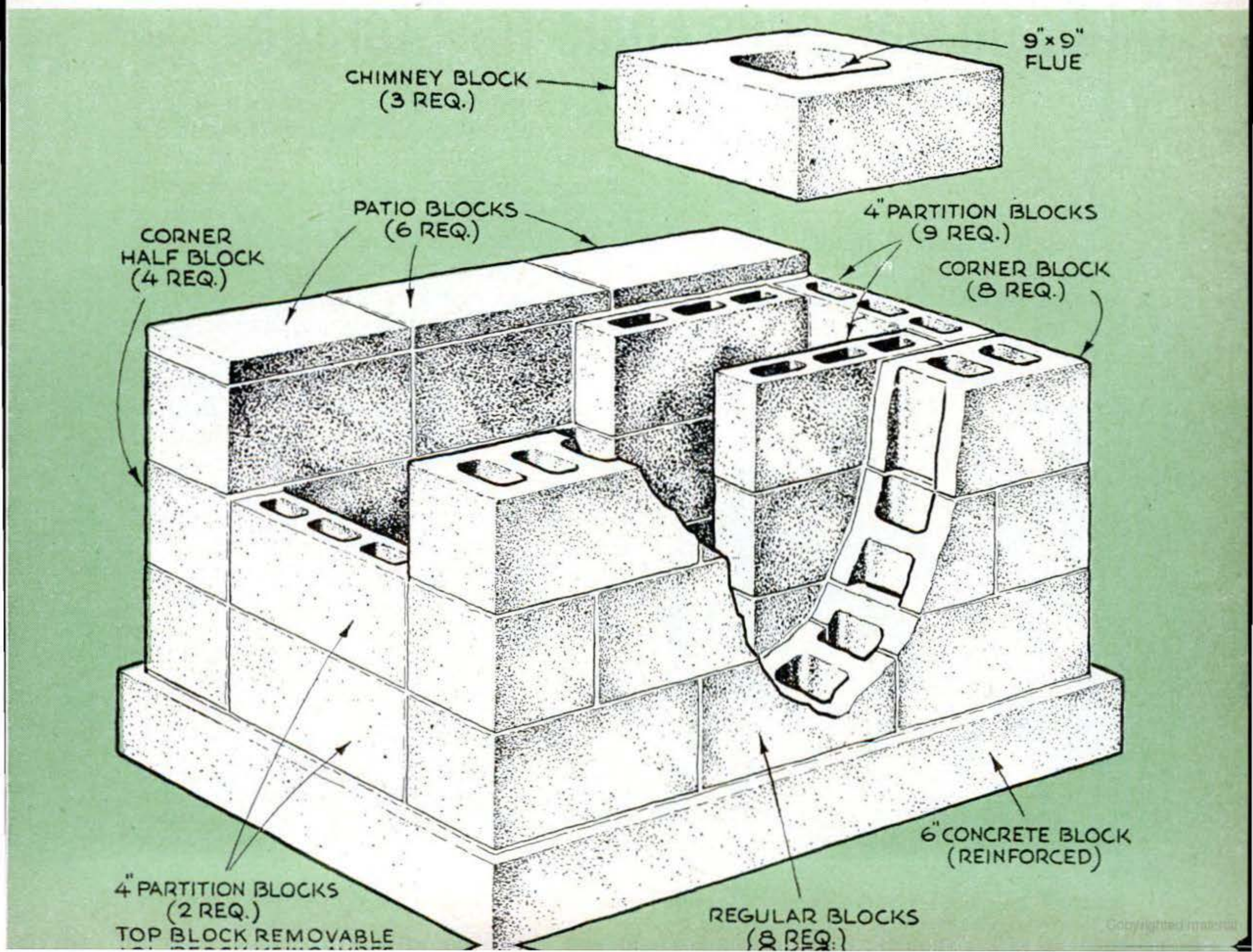
IT TAKES surprisingly few concrete blocks for even a good-looking unit like this, and they are so big the job takes shape fast.

In freezing climates, a 6″-thick reinforced foundation slab is desirable to prevent cracking. Use welded wire reinforcing, or ¼″ rods 10″ apart, running both ways.

For mortar, mix one volume of cement, one of hydrated lime, and five of mortar sand, or buy the mortar ready-mixed. Eight regular, eight corner, and four half-blocks are needed, plus 11 partition and three chimney blocks. The partition blocks, which are half the thickness of ordinary ones, form the back and inside ledges on which the chimney rests. Two similar blocks are used for the front. Fill the space between with sand to provide a fire surface at suitable height. The patio block also comes in half sizes, so it can be staggered if you like.

A solid metal plate, as shown in the photo above, has advantages over an open grill. It insures more positive draft and confines the smoke to the chimney. Leave it removable in case you want wiener roasts. Cement only the lower front block; a second loose one can be set in to control draft.





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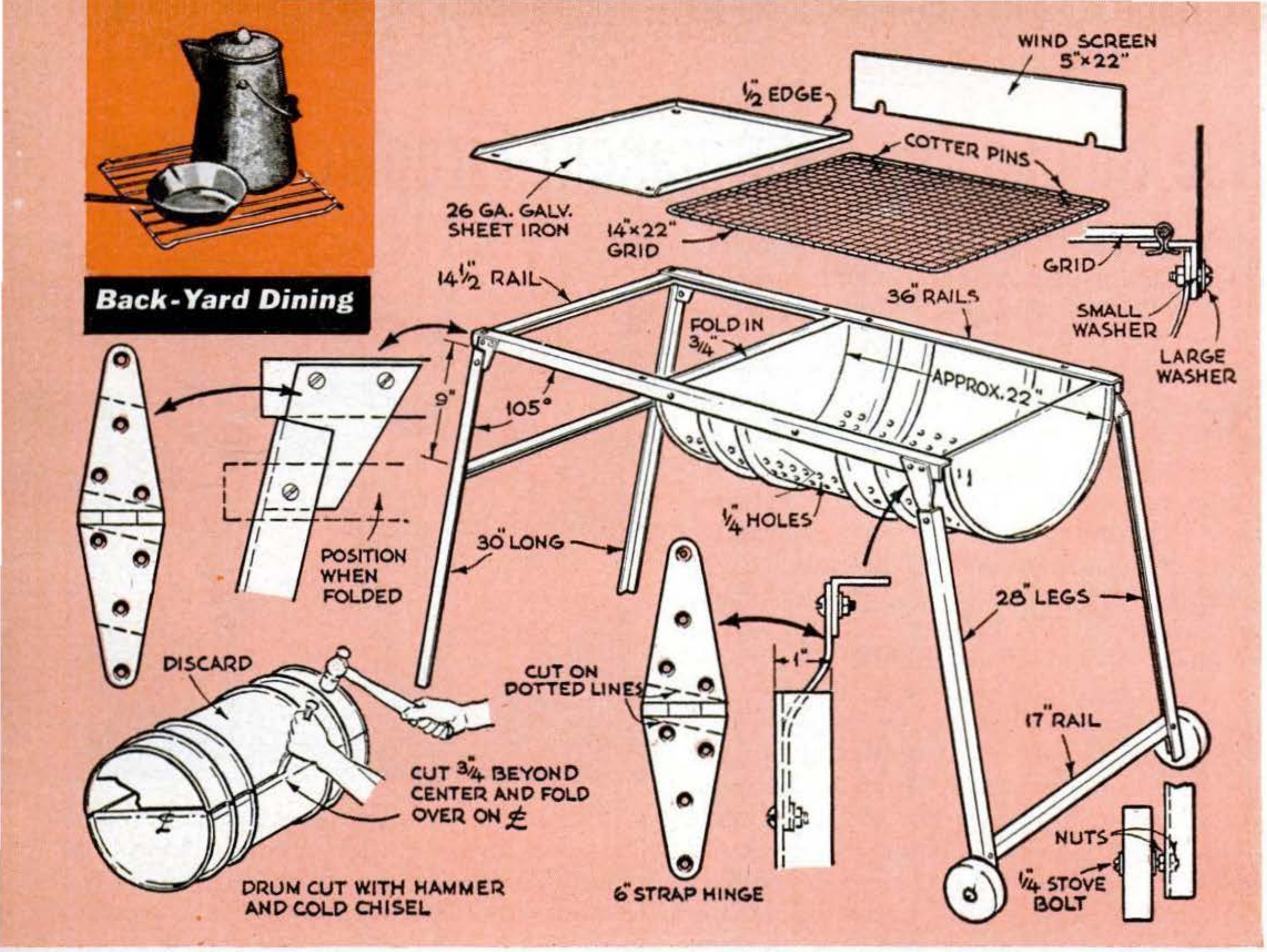

Oil-Drum Barbecue Folds for Storage

ABOUT two dollars judiciously spent at a junk yard will provide most of the materials for this folding back-yard grill. Get a small oil drum, about 18′ of 1″-by-1″ angle iron, and a refrigerator grate.

First, cut the drum lengthwise, leaving ¾″ tabs at the ends. Fold these over. Then cut angle-iron side rails 36″ long. Drill holes to bolt them to the drum in at least three places. Cut and fit the end rail and bolt or rivet it and the drum to the sides.

Pivot plates for the legs can be cut out of strap hinges, as shown in the drawing, although any plate of similar thickness will do. If the legs are mounted at an angle of about 105° when open, they will be stable without braces. The plain legs should fold inside the wheeled ones, so the latter are set out 1″ on each side by bending an offset in the pivot plate.

After the legs are in place, set the frame on a level surface to determine where to drill the wheel-axle holes, since this will depend on the wheels you use. Any from 4″ to 6″ in diameter will do.

Drill the draft holes in the bottom of the drum, bend up three sides of a 15″ square of sheet iron, and bolt it to the frame. Attach the grate with cotter pins as shown in the drawing. Make a sheet-iron wind screen with ¼″ turnovers on three edges and slot the lower edge in two places for mounting.

Wire-brush all parts clean. Then apply metal undercoat and two coats of outdoor enamel. When these dry, you're cooking with fire.—*Ralph S. Wilkes, Keuka Park, N.Y.*

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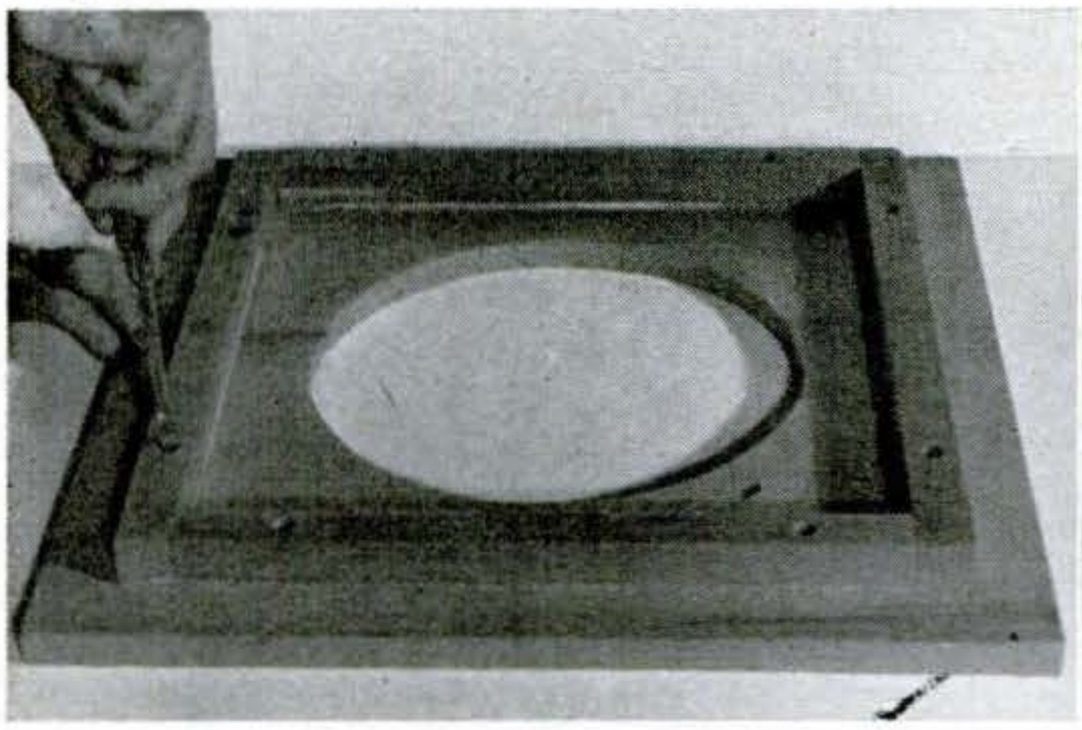
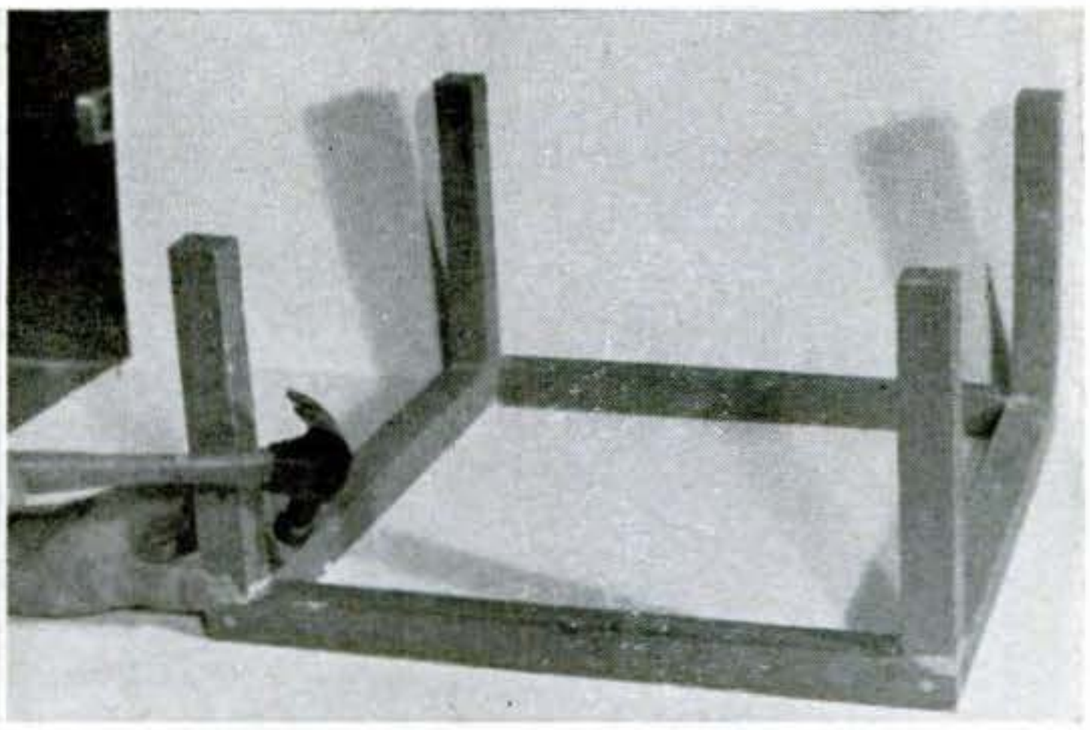
Portable Charcoal Stove Can Be Used Indoors or Out

By John Rogers

BORROWED FROM JAPAN, this charcoal stove, or *hibachi*, provides hot food both for outdoor buffet suppers or, if you like, indoors on the fireplace hearth, where the smoke will go up the chimney. The fire is built in a 10″ cast-iron casserole, costing about $3, and the wire trivet supplied with the vessel is converted to a grill by crisscrossing two pieces of wire through it to rest on top.

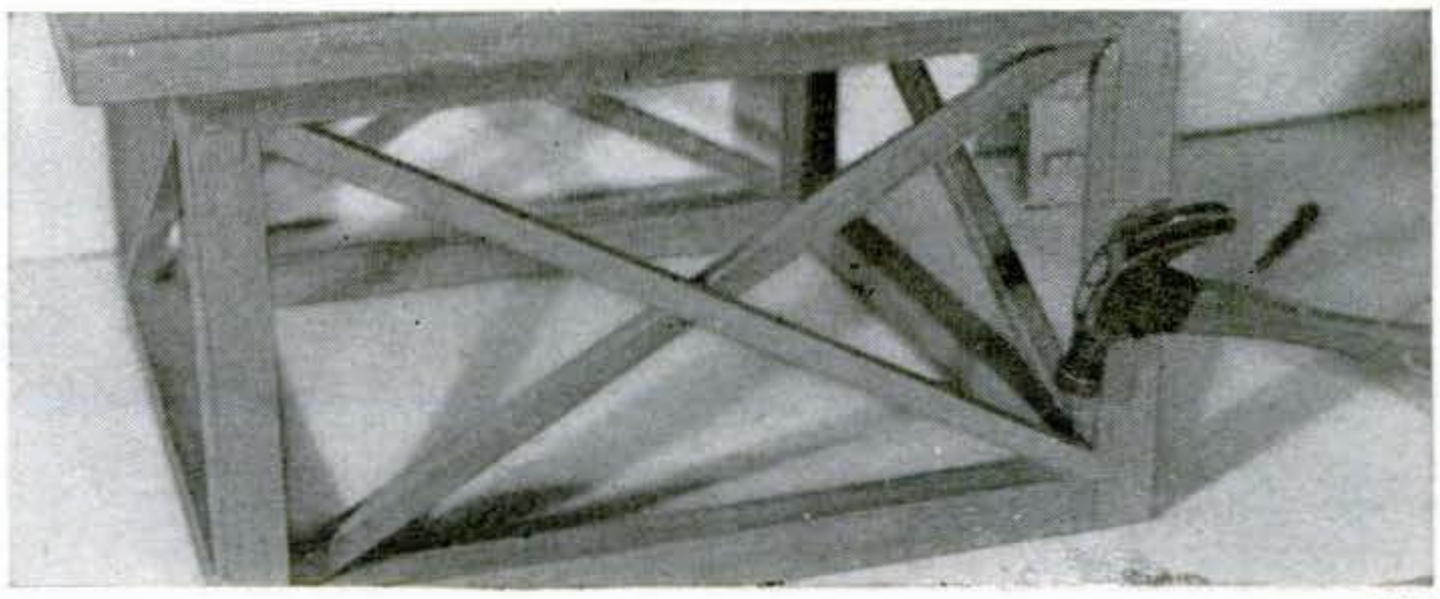


CUT OUT A HOLE in the 18″-by-18″ wooden top to fit the cast-iron casserole. Top should be ¾″ thick. To let the pot sink flush with the surface, recesses are cut in the upper surface to receive the handles. A 15″-by-15″ frame of 1″-by-1″ stock is screwed fast to the underside of the top.



MAKE ANOTHER FRAME for the bottom just like the one screwed to the top. Then cut corner posts of 1″-by-1″ stock 7½″ long. Glue and toenail these posts to both frames, top and bottom. Use No. 3 finishing nails, well set and puttied over. Assemble posts on base frame first as shown.

FIT CROSS BRACES of ½″-square stock by mitering a corner on each end to fit within the frame. Glue and nail one brace flush with the inside edges, and the other with the outside edges, using 1¼″ wire nails. Line the inside of the hole with sheet asbestos to keep the hot pot from charring the wood. Clear or colored lacquer, waxed, makes a good finish.



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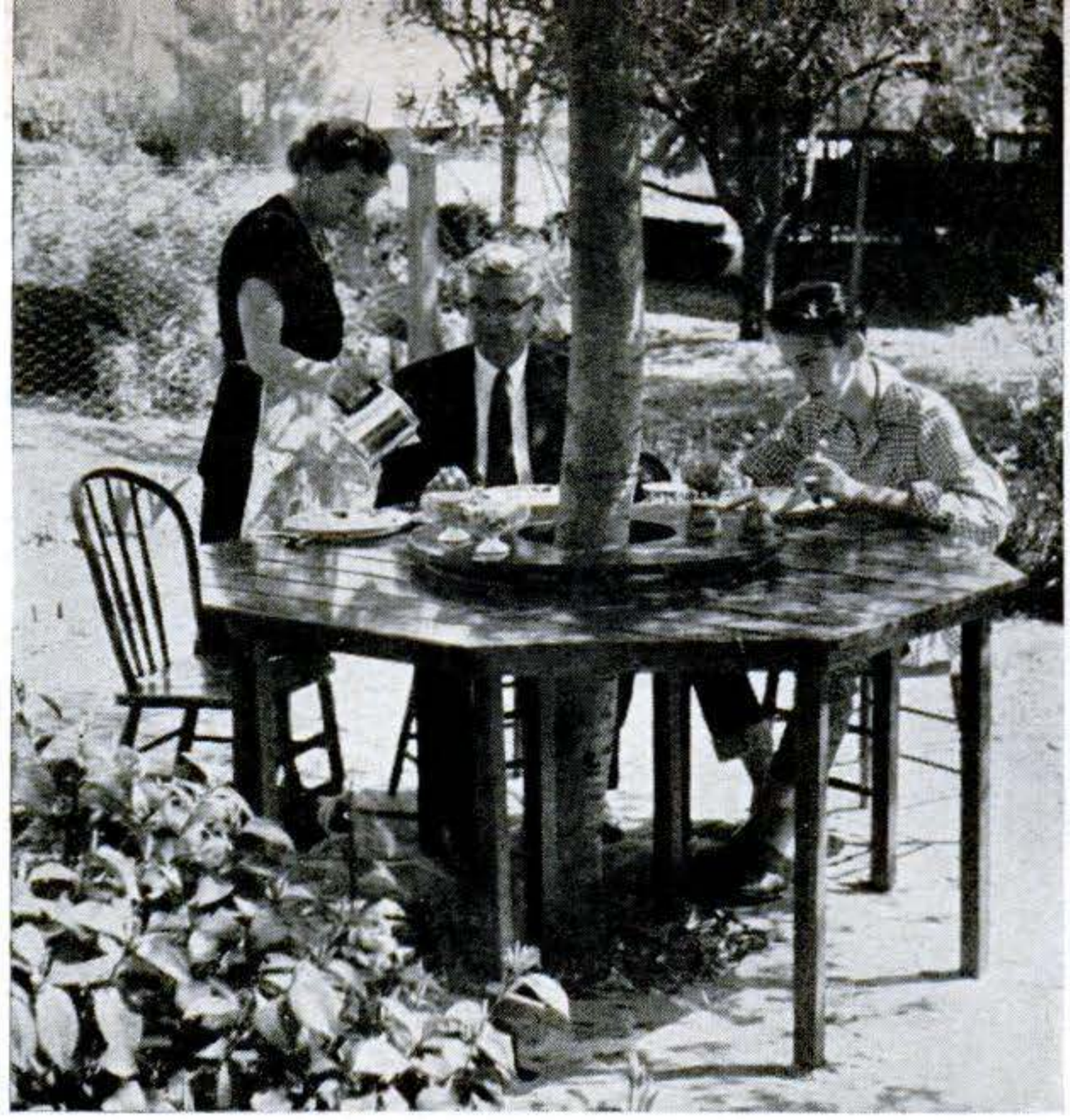
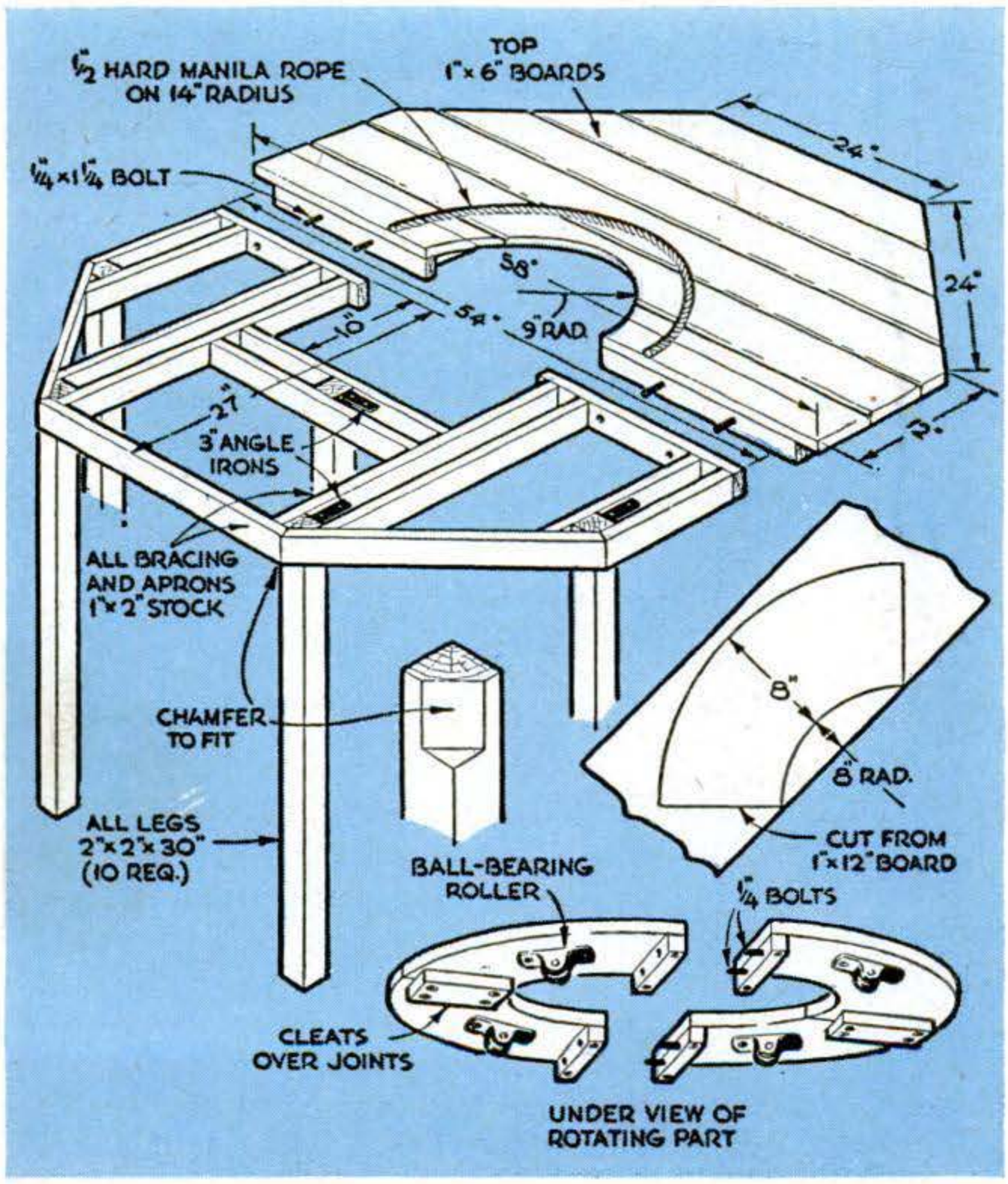
Round-the-Tree Table Has a Lazy Susan Tray



THAT barbecue will taste even better around a comfortable table like this. A Lazy Susan in the middle turns to bring the trimmings within everybody's reach. Its eight sides will seat eight diners, with plenty of elbowroom between. Unscrewing four wing nuts lets you remove it from around the tree for winter storage.

Begin by making the two frame halves of 1″-by-2″ stock, spacing adjacent cross members to a close fit for the leg stock. Assemble with six-penny finishing nails. Chamfer the corners of the legs as required to fit into the corners, screw on 3″ angle-iron brackets flush with the top ends, and nail the legs in place. The top shown was made of redwood shiplap, with the joints drawn close and the V notches upward. Ordinary boards, left with small gaps for drainage, will also do. You can use four-penny finishing nails, set and puttied over, to fasten them to the frame. Then screw the legs of the angle irons to the top. With composition-wood or other weatherproof filler, fill the grooves in the circular area over which the Lazy Susan caster rollers will travel.



The Lazy Susan is made of four quarter-circles, cut as shown with the long grain of the board. Screw two ½″ cleats over opposite joints, and bolt cleats to both members of each of the other joints. The casters are screwed on at quarter-circle intervals. To keep the Lazy Susan in place, nail a circle of rope to the table top as shown, or tack on a track made by bending light aluminum angle to a suitable radius, first slitting the flat, or nailing, flange to prevent kinking. Add a rim to platform by nailing linoleum binding or some flexible metal around edge.—*Wilma Mitchell, Glendale, Calif.*

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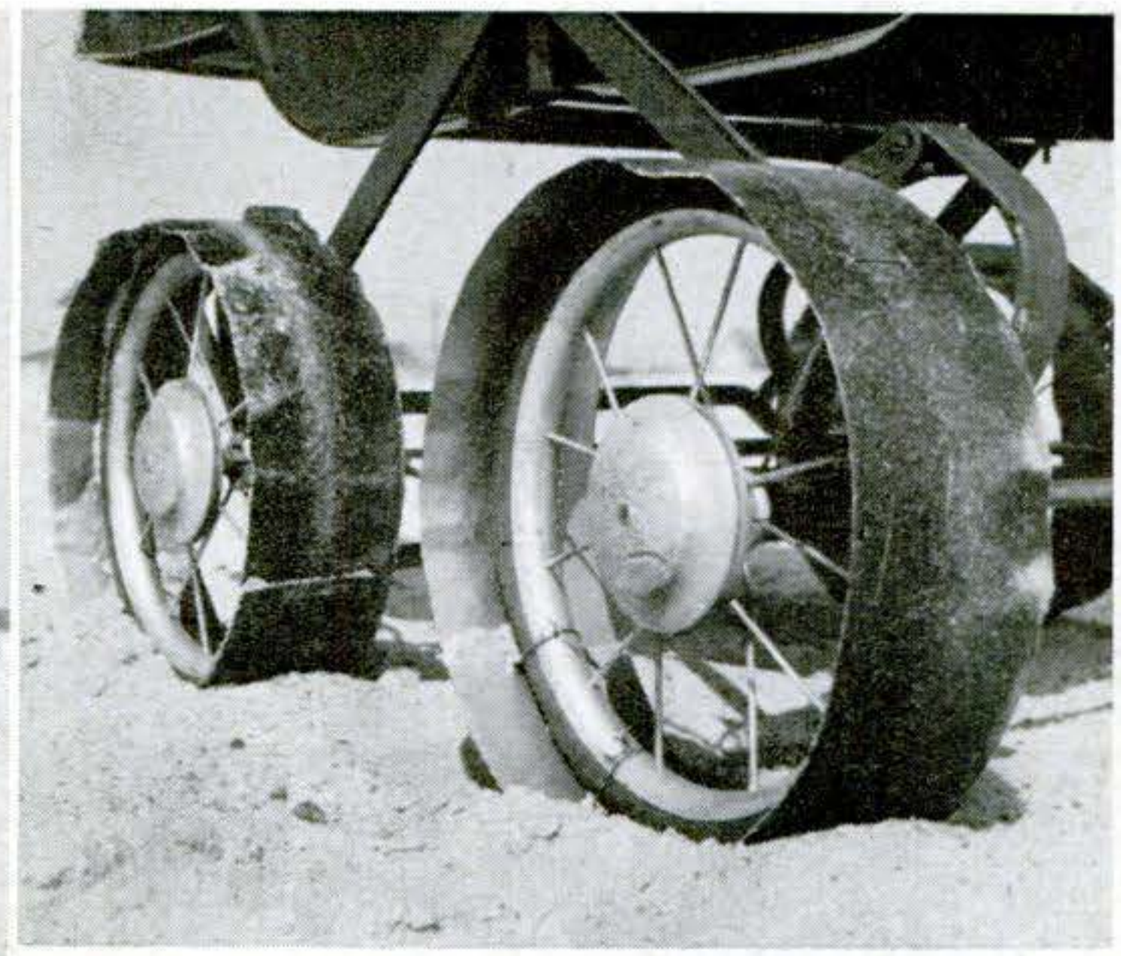
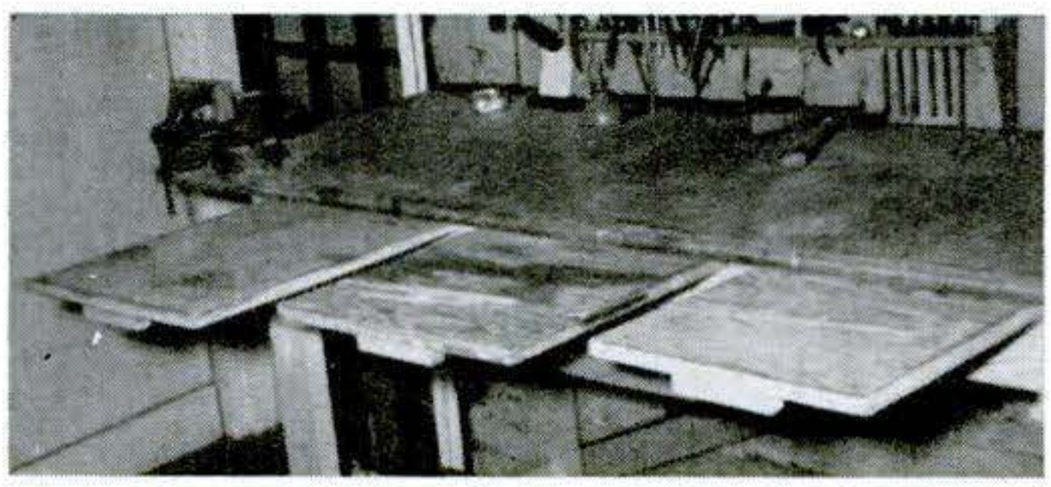


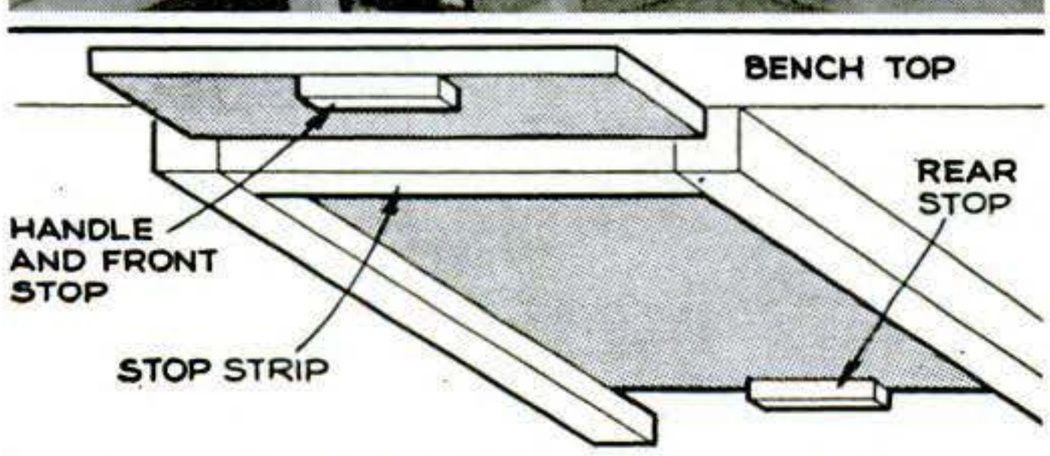
Baby Buggy Rolls on Sand

A BABY carriage will roll right down to the water's edge at the beach this summer, if tin strips are wired to the wheels like this. Equipped with the wider tread, the wheels then won't sink so far into soft sand.

Roofing tin, in strips about 4″ wide, was used in this case, the strips being cut long enough to go around the wheels with a 3″ overlap for fastening. Holes punched in the tin allowed the strips to be pulled up snug against the tires and then wired securely in place.

In time, the edges of the strips may crinkle somewhat, but this does not seriously take away from their traction value. *—John Hoke, Washington, D. C.*

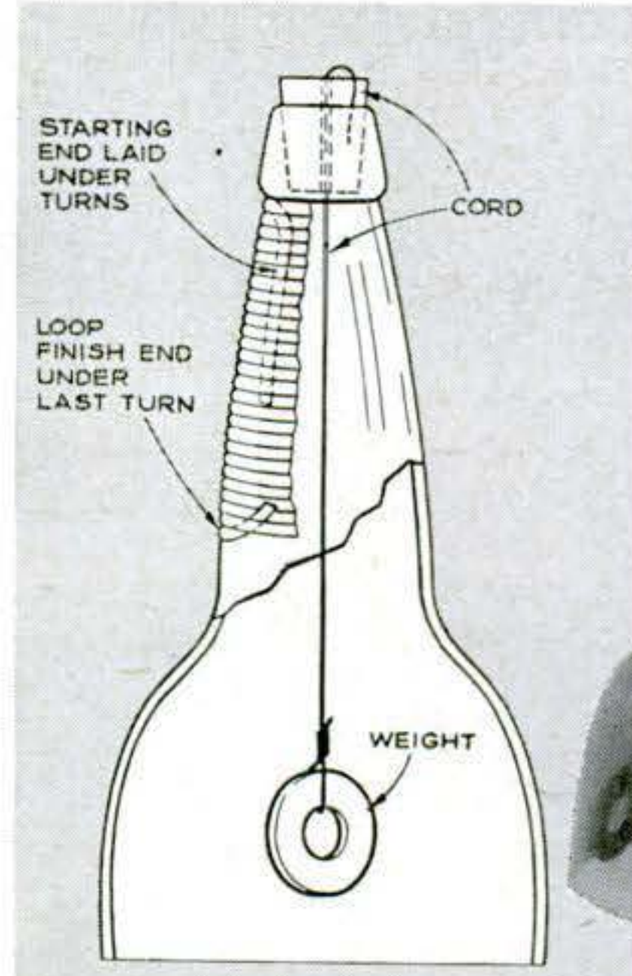




Leaves Add to Workbench Area

ONE or more pull-out boards like those in the photo above are worth adding to any workbench. When the bench is littered, you need only pull out a board to have a clear working surface. They also are handy for supporting outsize projects.

Make the leaves of ¾″ plywood for strength. Screw heavy rabbeted guides to the underside of the bench top with a strip across them at the top. Add a stop block at the back of each board and a handle to pull it out by.—*A. Roger Grout, Meadville, Pa.*



Cut-Down Bottle Rings the Bell

HERE'S a conversation piece that speaks in ringing tones. Cut a long-necked bottle by scribing around it or using an electric resistance wire (PSM, Feb. '54, p. 196) and grind the edge smooth.

Draw a piece of fish line through a hole in the center of a cork, tie on a small sinker and drive the cork in tightly. A wrapping of raffia or plastic lacing around the neck makes a nonslip grip.

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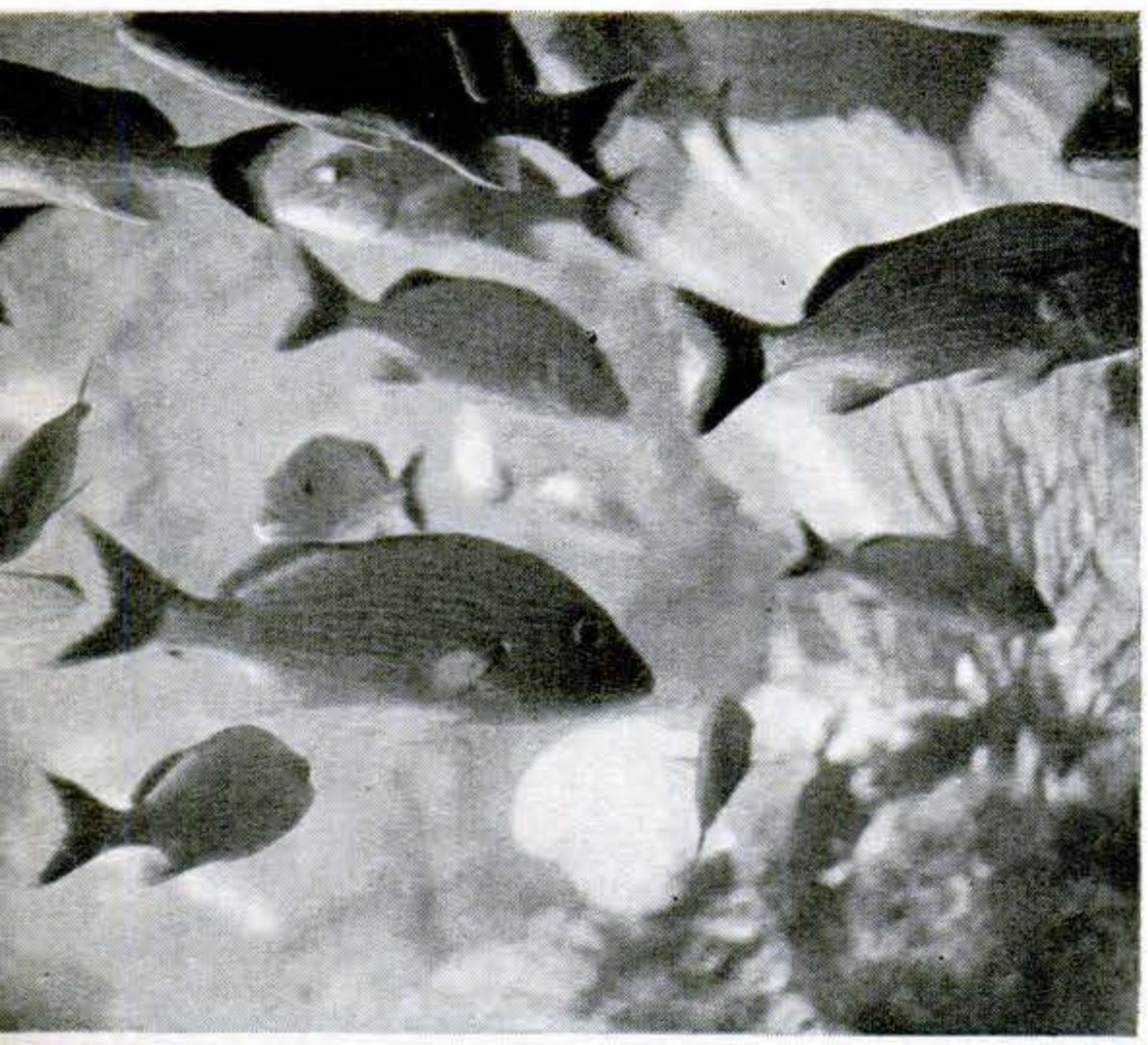
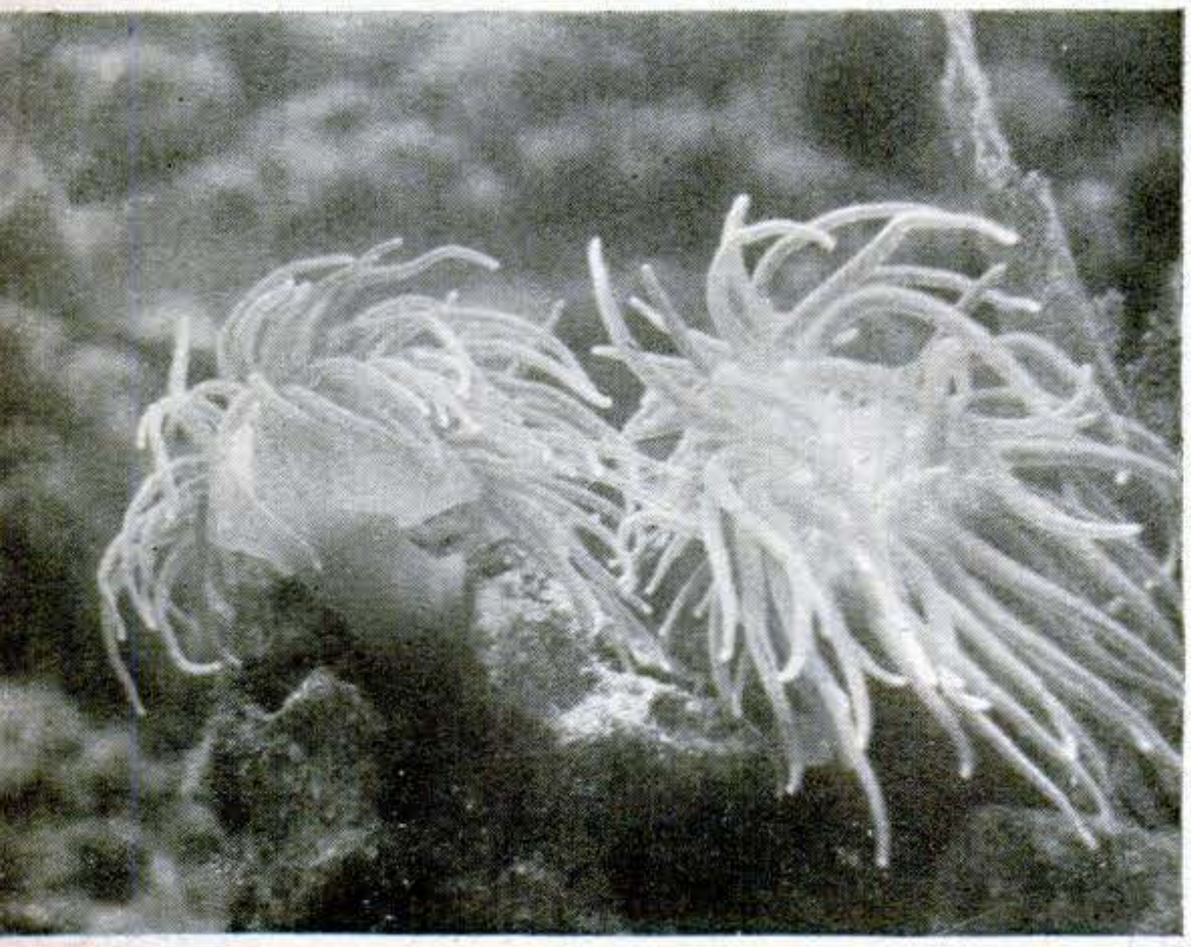
ROY PINNEY scans sea-life scene with movie camera. Equipped with only swim mask and fins, he can stay under water for 60 seconds.



DRAMATIC UNDERSEA PARADE. To attract fish, use an angler's trick: drop toast or bread into the water and they'll come swimming.



SEA ANEMONES, with fragile fingers waving, caught in close-up against coral background. You needn't go deep for beauty like this.

His Photo

This diving cameraman captures

By Dave Stanley

IF YOU can swim you can take pictures under water. You don't have to be a deep-sea diver. You don't need a lot of fancy and complex equipment to bring back on film the mystery and beauty of the silent

Action accents this fine portrait of a hawksbill

Studio Is Under Water

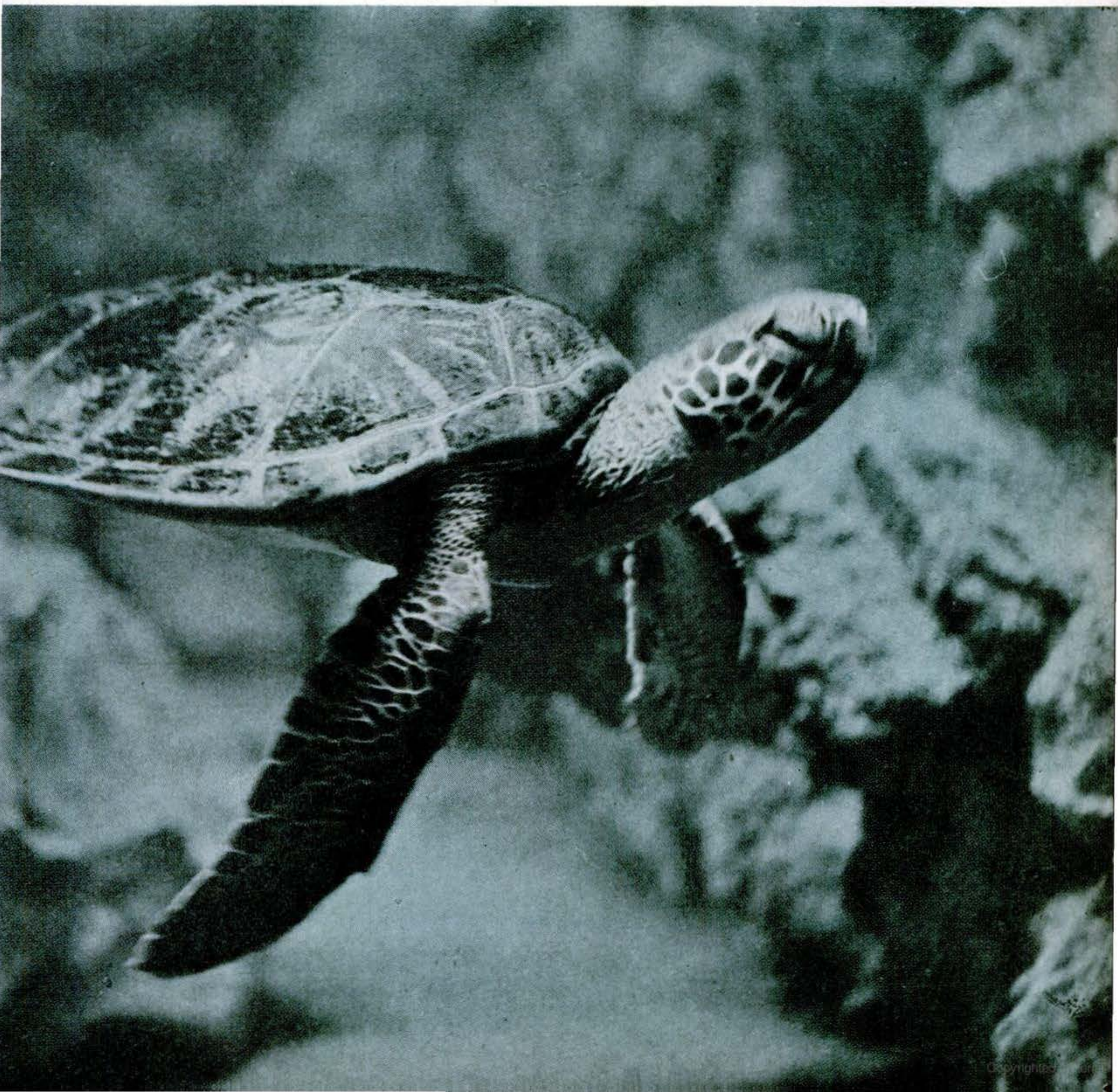
a weird and wonderful world. You can use many of his tricks.

world that you will discover under the sea.

Next to a camera in a watertight container, probably the most important equipment you can take down with you is some tips and words of advice from a veteran underwater photographer. One of the best is 42-year-old Roy Pinney.

A naturalist-photographer for more than 20 years, Pinney photographed the William Beebe bathysphere descent in 1936. Since 1949 he has been nosing his cameras into the clear, warm waters off Bermuda and Nassau, shooting picture stories of underwater life, spear fishing, skin diving. So

turtle. It was shot at a shallow depth to take advantage of sunlight penetrating the water.



he knows what he is talking about when he exclaims enthusiastically, "There's literally a new world down there for cameramen to conquer."

He also knows what he is talking about when he warns the amateur to keep his distance—six to 15 feet from the underwater subject. "Once you get outside that area," he says, "you're wasting film. Your pictures will be fuzzy and murky."

The reason for this shooting rule is the loss of light under water. Sometimes you can bend the rule a little. That sometimes is when there is sparkling sunlight overhead and bright reflection from a white-sand bottom.

If you've just bought yourself fins and a swim mask, and your first watertight camera is ready for action, don't start plumbing the ocean depths as if you were going to film "20,000 Leagues Under the Sea." Pinney's advice: "Start shooting in shallow water—five to six feet. You will get experience handling your equipment and you can stand on the bottom if necessary."

That doesn't mean, however, that the camera-toting wader won't come up with some good stuff. On the contrary. The shallower the water the stronger the illumination, with better chances for good pictures photographically. And, Pinney reminds, there's a wonderful parade of marine activity and plant life in shallow water from five to 10 feet.

Now that you're down, the camera has to be kept steady as a jetty. That isn't always easy when currents start bobbing you around. Weighting the camera helps. Attach a few pounds of lead weights, enough so that the camera sinks slowly; it will neutralize the buoyancy of the water.

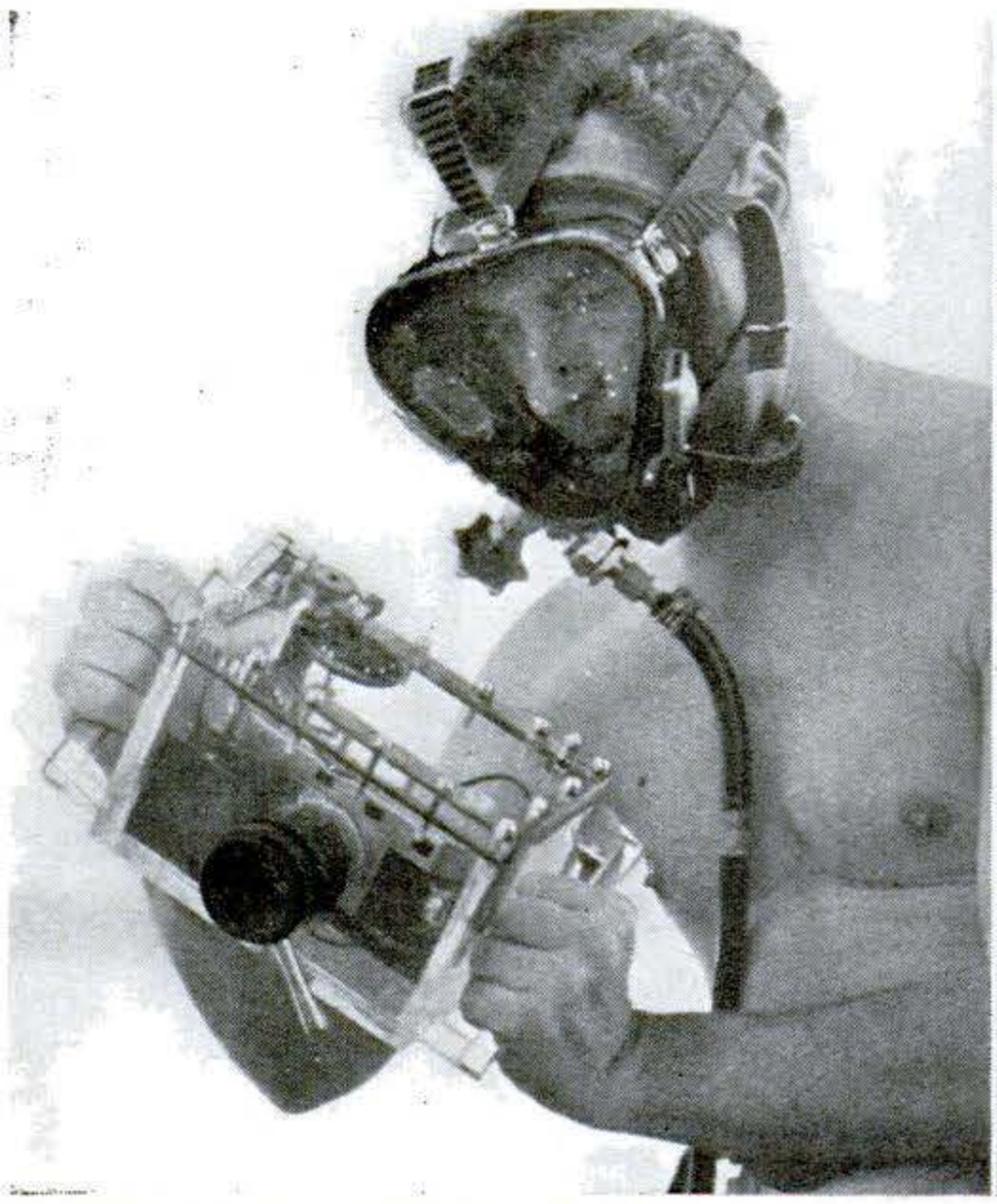
In time you will be lured down into deeper water. Then you will need lead weights for your own body. "I've used a lead belt weighing from 20 to 30 pounds," says Pinney. "How much weight you need depends on your own weight and how far down you want to go. Before you go down, make a safety check to be sure that you can unclasp the belt with zipper speed in an emergency."

Camerawise, here's what Roy Pinney carries for his underwater photography: (1) a Clarus 35-mm. camera enclosed in a Plexiglas container; (2) a Cine-Kodak

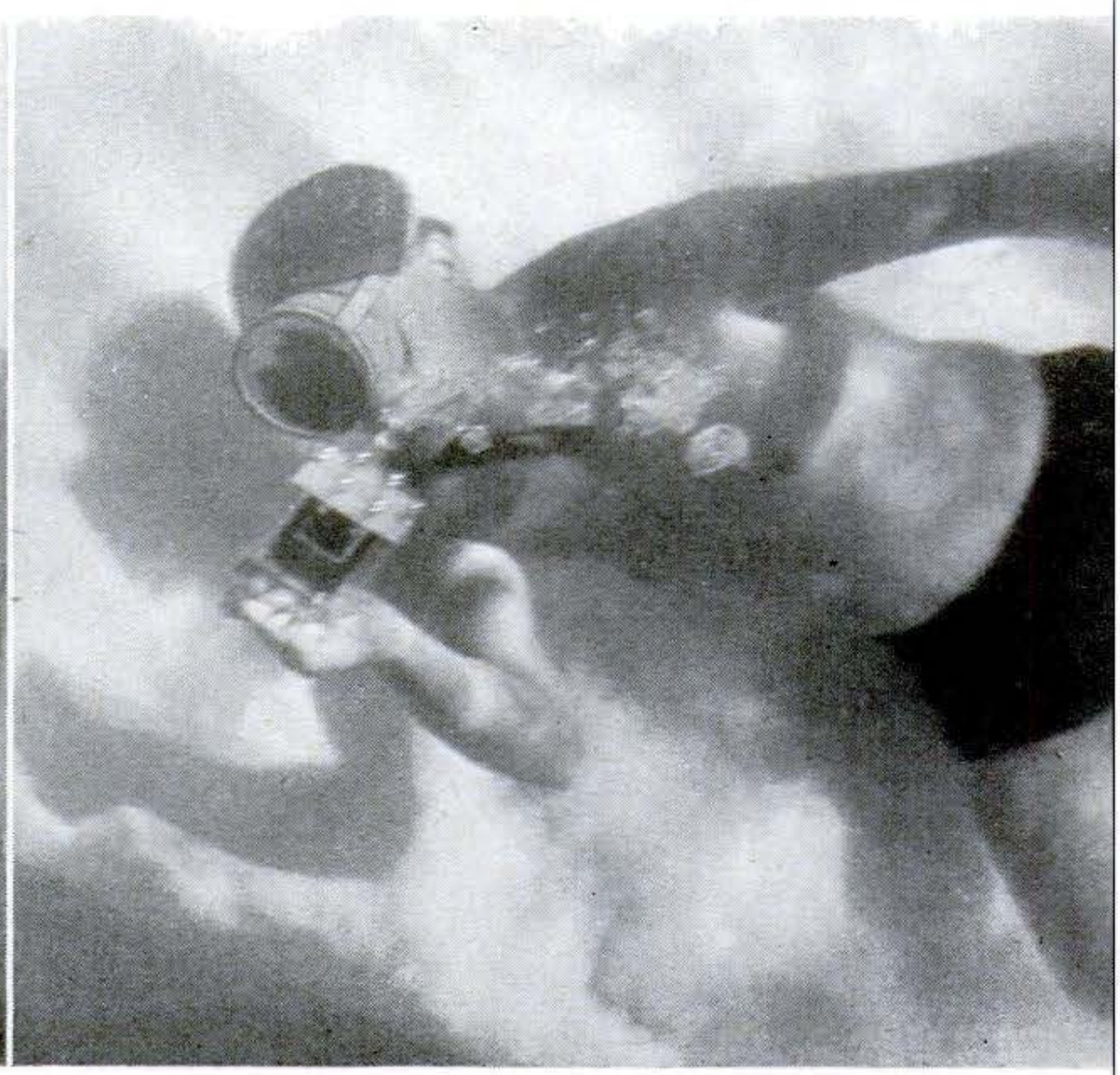
HINT TO AN UNLUCKY HANDY MAN

One man can't think up everything
But there's no use denying—
You won't invent a single thing
Unless you keep on trying!

—Hugh Lineback



A SPECIALLY DESIGNED plastic case encloses photographer Roy Pinney's Clarus camera.



WATERPROOF CASE, or glass jar with tight lid, enables exposure meter to be used in water.

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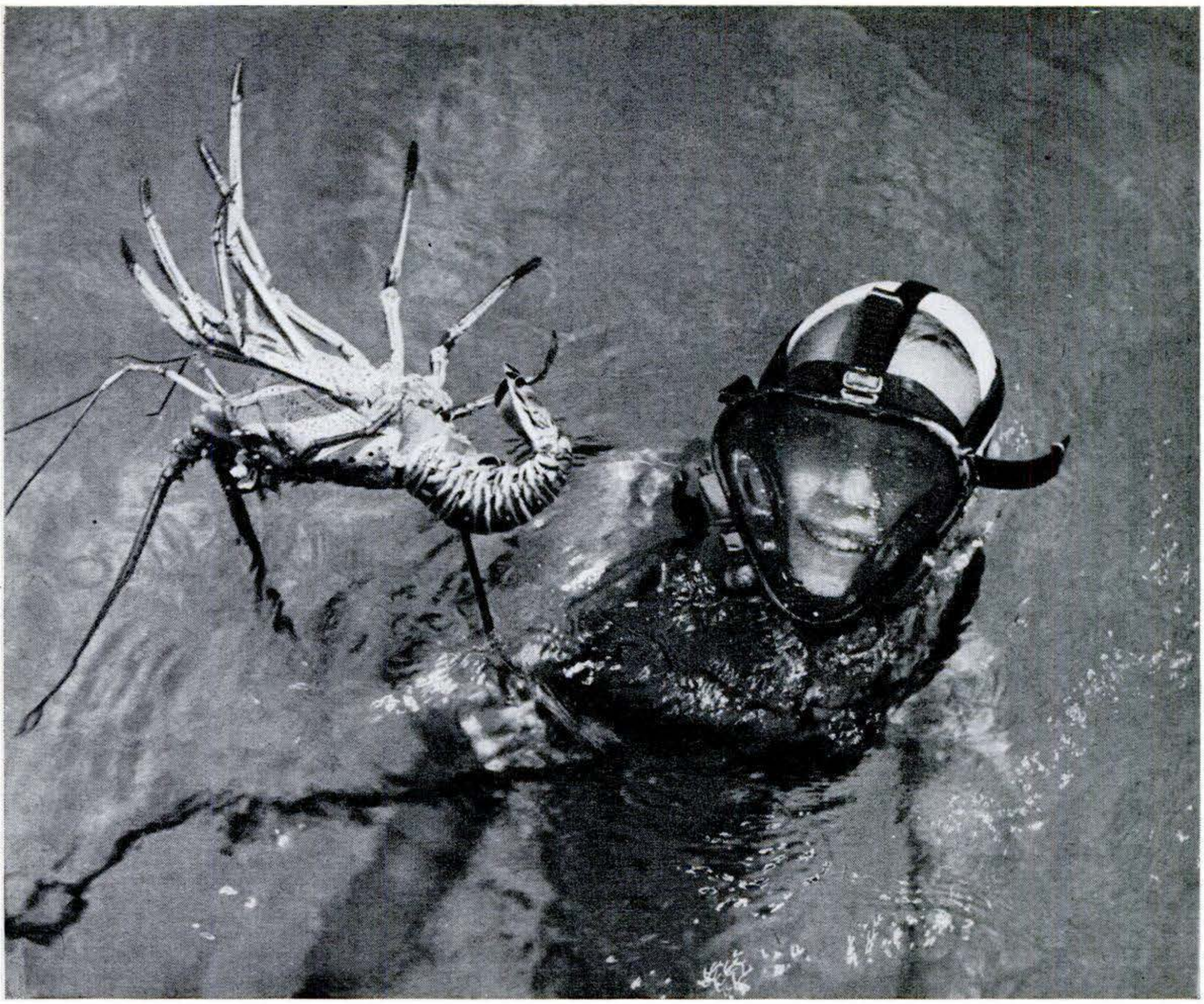

Underwater photography often results in a good meal, too—as witness this huge crayfish.

magazine, 16 mm., with a homemade water-tight container.

Speed is a keynote in his choice of film and lens. "I use high-speed panchromatic, super double X. For color I use a very fast lens, f/3.5 or faster."

In shooting, he reports good results by clicking at 1/100 of a second for black-and-white; 1/50 of a second for color.

When it's slightly overcast, shoot half as fast. "This is not true all the time," Pinney qualifies. "There may be a lot of reflection from white sand on the bottom."

Today, most spear fishing and underwater photography centers around the Bahamas, Florida and California. But America's thousands of lakes and endless miles of rivers offer a creative challenge. "In lakes and rivers," Pinney points out, "you can take interesting shots of your girl friend, swimming meets and other water sports. And if you are quick-eyed and lucky, you may even catch a beaver or muskrat."

Experience has taught Pinney never to be careless under water. He has set up a safety program for himself—and you:

1. Never swim under water without friends nearby.
2. If you scratch yourself on coral, get it cleaned at once. Otherwise festering sores may result.
3. If you have allergies or sinus trouble, check with a doctor before taking your camera under water.
4. Watch out for sea urchins. These fish have spines. If you step on one, see a doctor.
5. Wear foot fins if possible. Not only do they propel you faster, but they protect your feet against broken glass, jagged coral and those spiny fish.

"Take it down from there," says Pinney. "It's fascinating fun." END

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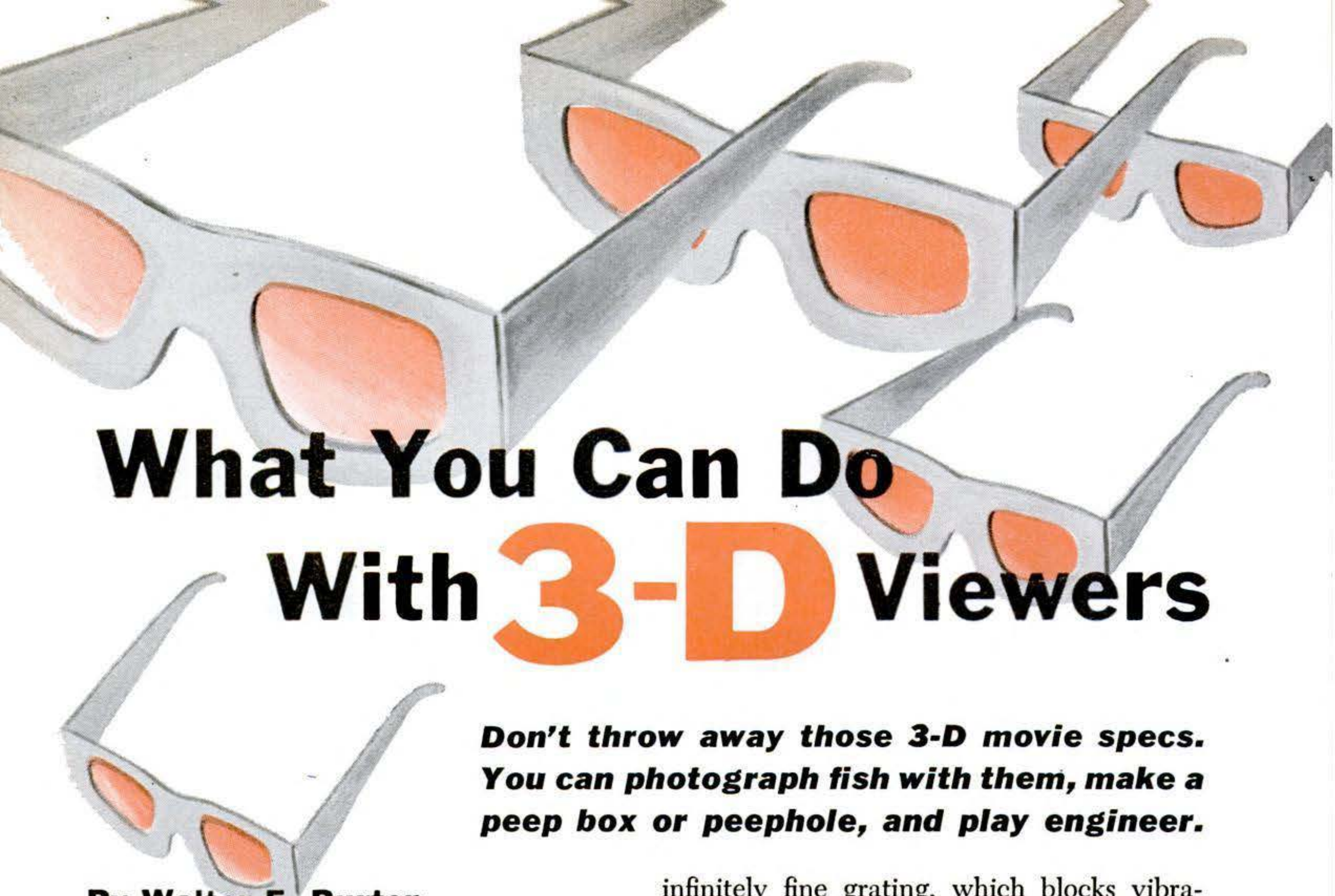


What You Can Do With 3-D Viewers

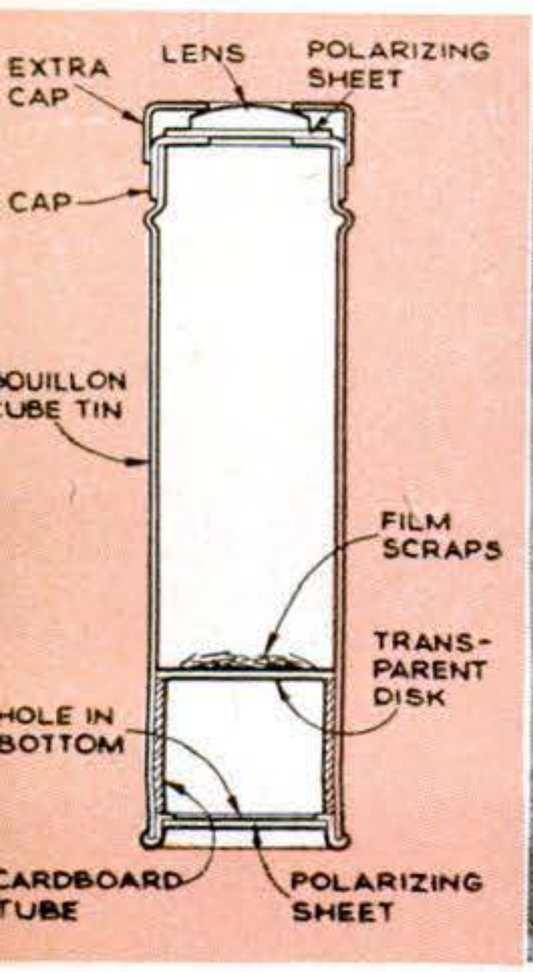
Don't throw away those 3-D movie specs. You can photograph fish with them, make a peep box or peephole, and play engineer.

By Walter E. Burton

THAT cardboard viewer you may have tossed away as you came out of the 3-D movie still has lots of entertainment value left in it. If you take one home, you will be able to peep into some fascinating new worlds.

What opens the windows on these is the viewer's ability to polarize light. Ordinary light vibrates in all planes perpendicular to its line of travel. But the polarizing material in 3-D viewers acts somewhat like an infinitely fine grating, which blocks vibrations at an angle to it and passes only those in the same plane. This screened light is polarized.

For 3-D movies, the two polarizers are set at right angles to each other. Cut the viewer apart, place one eyepiece in front of the other, and you will find that little or no light gets through. The diagram shows why. One polarizing element cuts off all light except that vibrating in its own plane. The other element, at right angles to the first, cuts out this residue.



Make a Color Peep Box

PUT bits of clear cellophane or mica into this gadget—then look through it into a wonderland of colors! Punch a ¼″ hole in two bouillon-cube can caps and cut out as much of the bottom of a can as possible. Cement one polarizing element and a small lens on top of one cap, press on the second, and scrape the paint off the can so that the assembly can be rotated on it.

Fit a disk of clear plastic or cellophane at the focusing point. Drop scraps of clear film on the disk, hold the can over a brightly lighted surface and look through. The colors change as you turn the top or shake the box.

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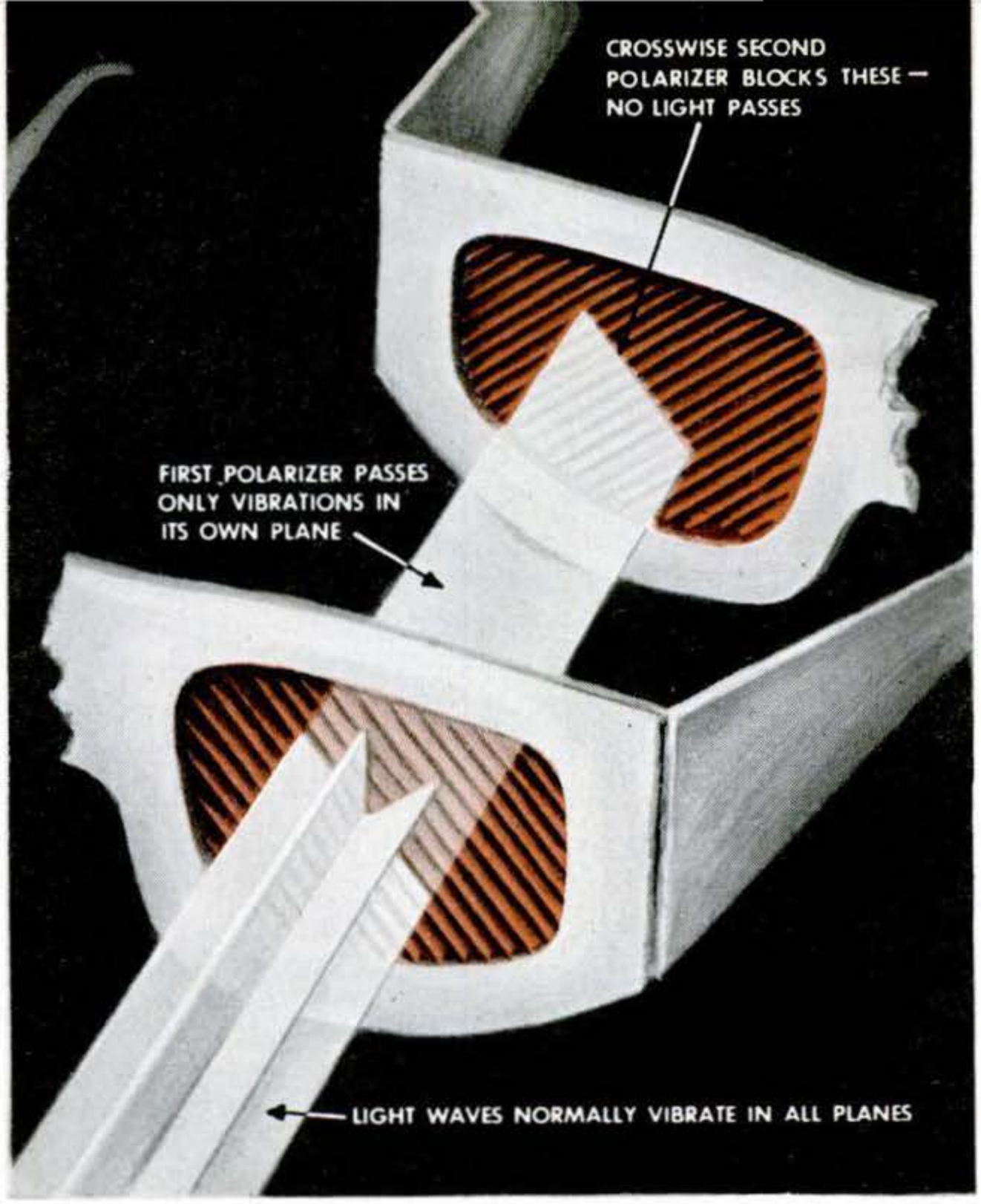
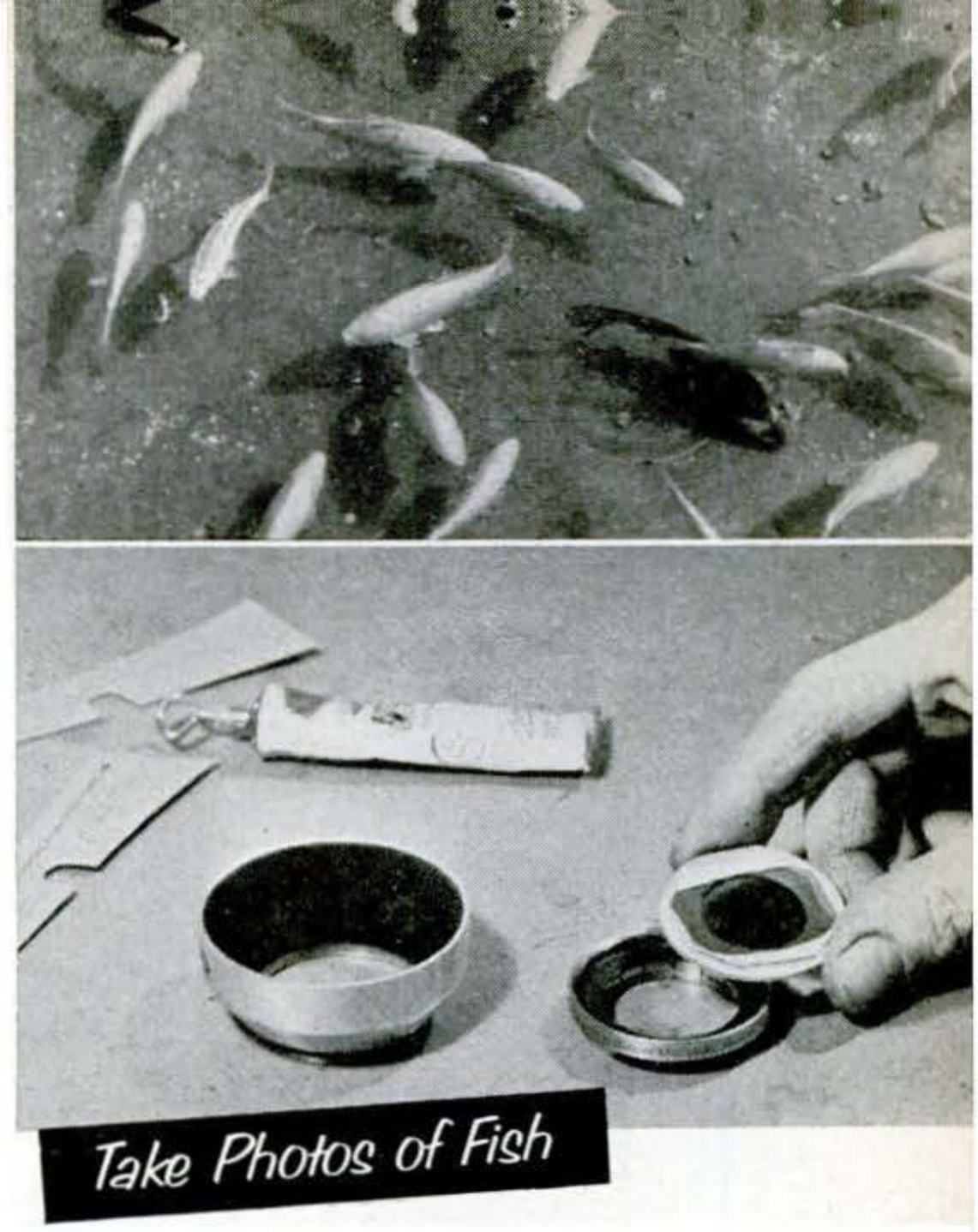


But turn either element so that the "gratings" come more nearly parallel, and more light passes through. You can use this effect in several ways—for instance, as a light dimmer on a microscope or a miniature stage, or to view visitors through a peephole in the door.

And that's not all. On these two pages, and the one that follows, you'll see how polarization can do such tricks as reveal colorless things in startling hues, make physical stresses in materials visible, and help you take photos of objects under water.



Take Photos of Fish

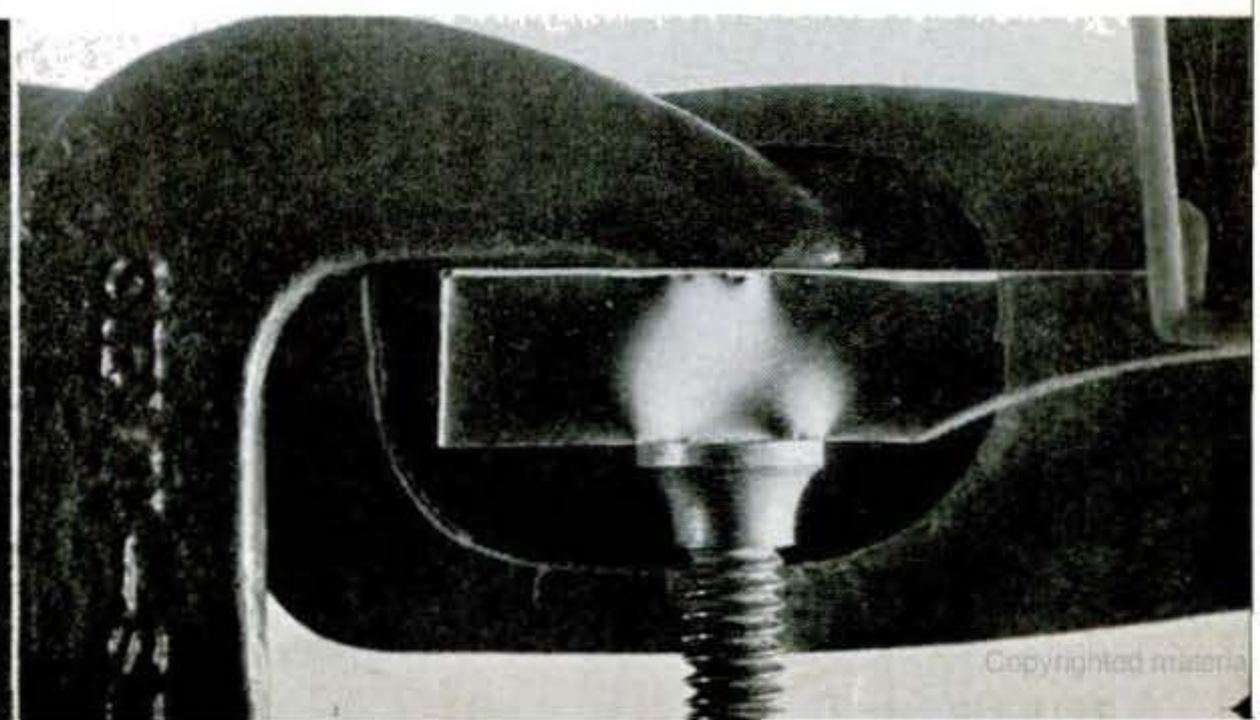
A POLARIZING filter on your camera makes it possible to photograph fish under water or get a clear picture of objects in show windows. By eliminating glare, it brings out depth and contrast in color photos. Cement a 3-D filter element to a cardboard disk cut to fit into a sunshade or filter holder, as above.

Hold the filter before one eye and turn it until glare and reflection are at a minimum. Then place the filter on the camera in the same position. (With a ground-glass or reflex camera, you can observe the filter's effect directly.) Increase exposure 2½ times to compensate for filter light loss. For the best underwater shooting, the angle between water surface and filter should be about 35°.

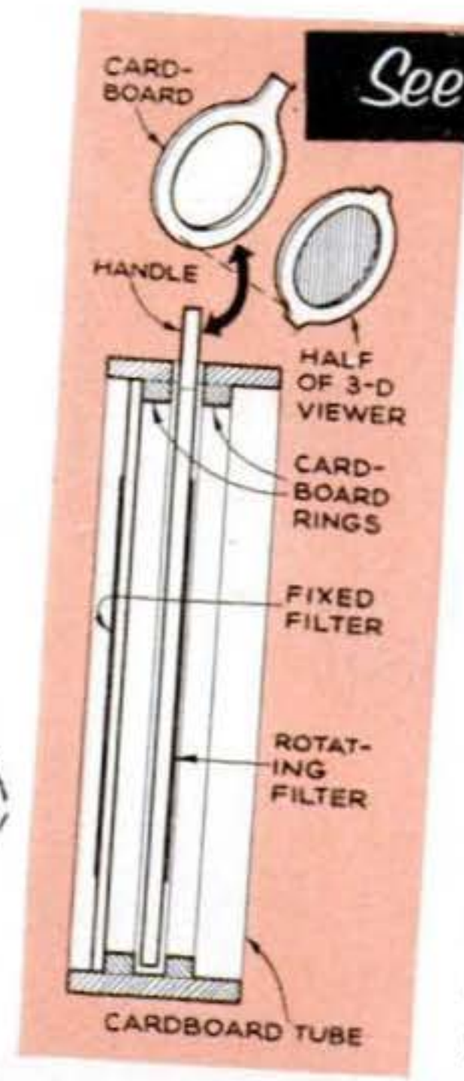
See Strain Inside Solid Materials

ENGINEERS can tell where strains are concentrated in girders, bolts, turbine blades and other parts by illuminating plastic models of such things with polarized light. Place one viewer element behind a bit of plastic and direct a lamp to bounce light off a white background through the plastic. Place another polarizing filter in front of your eye.

Depending on how you turn the filter, strains set up in the plastic by clamping, twisting or bending it will show up as bright spots against dark, or dark spots against light.



3-D VIEWERS

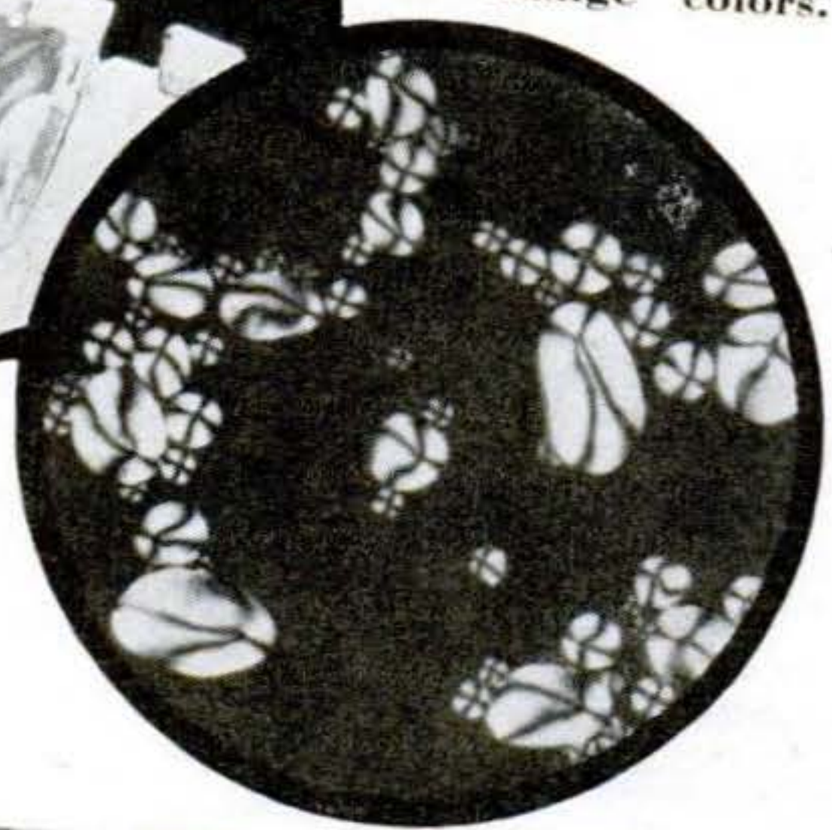


See Out--and Stay Unseen

Two disks of polarizing material in the front door will enable you to screen your callers. Cement one filter permanently over a peephole. Mount another so that it can be rotated in front of the first. It will be almost impossible to see through the two from outside, even when the inner element is turned to let you look out. The drawing shows how to make a filter mount of cardboard.

Polarize Your Microscope and See the Invisible

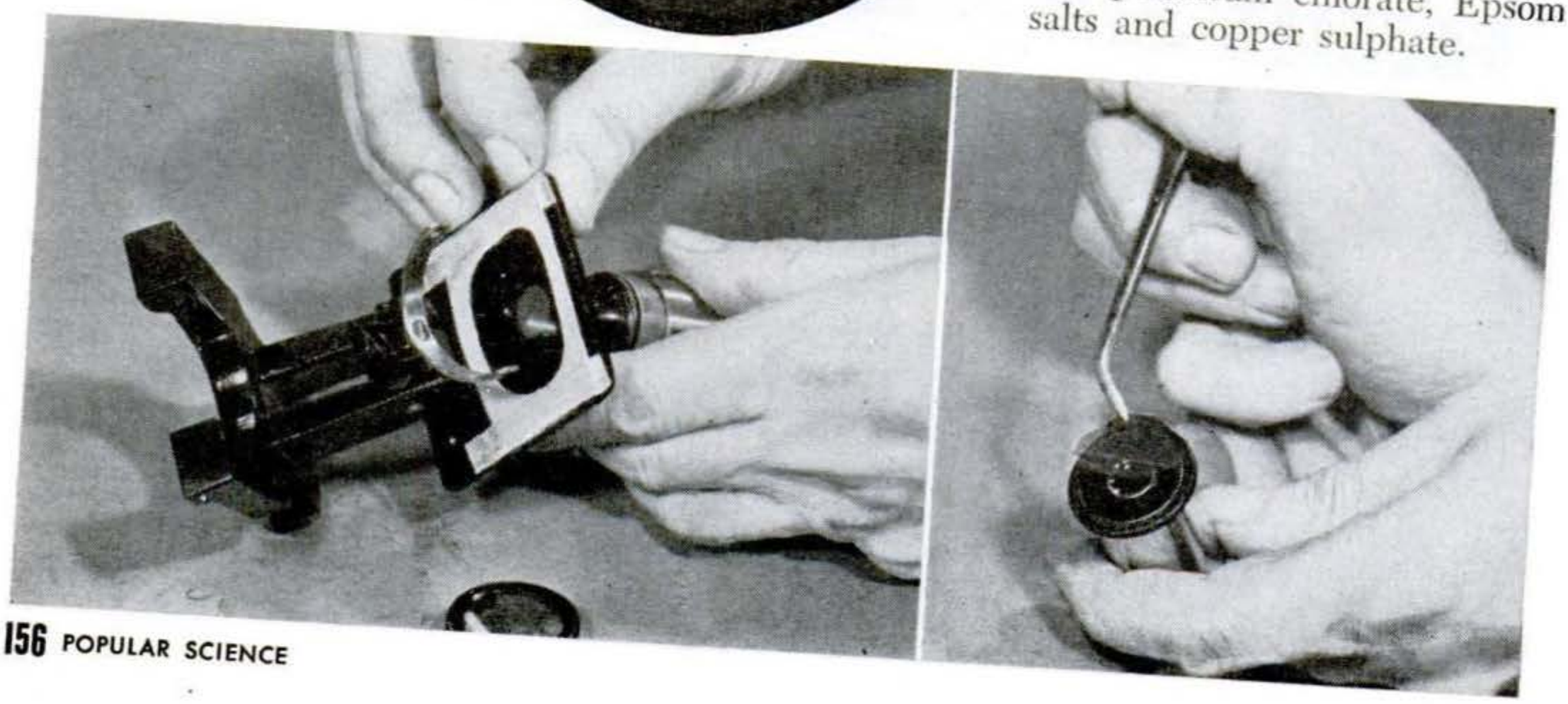
SOME CRYSTALS of colorless chemicals glow with rainbow hues by polarized light. At left are potassium chlorate crystals. Turn lens to change colors.



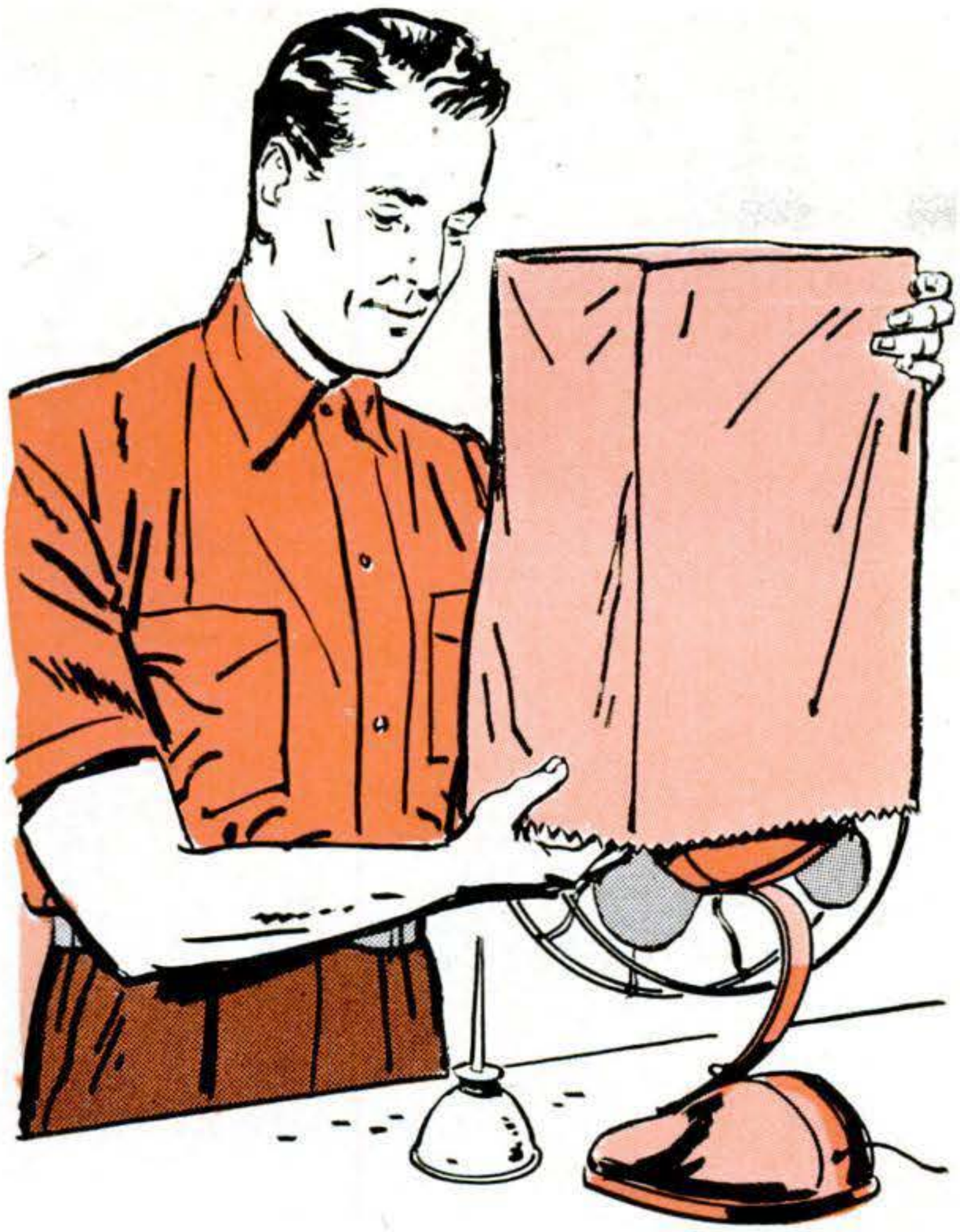
POLARIZED PATTERN (right) shows in potato-starch grains (obtained by diluting potato scrapings with water). Pattern is typical of starch.

THE invisible shows up when polarizing filters are added to a microscope. Many transparent or translucent objects barely visible by ordinary light show brilliant, colorful detail when viewed this way.

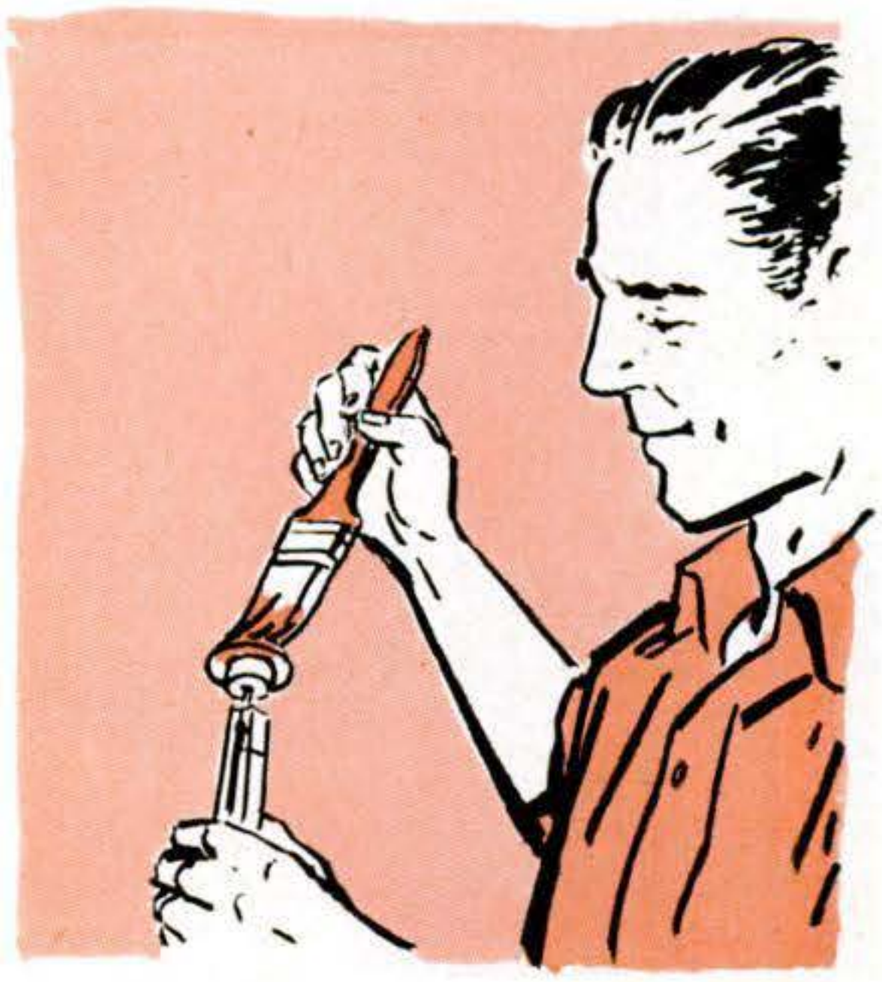
Tape one viewer element to the underside of the microscope stage (bottom left). This will polarize light passing through the slide. Stick a second bit of polarizing material over the eyepiece lens (bottom right). If the eyepiece cannot be turned in the barrel, mount filter on a separate cap or ring to permit it to be rotated. Try looking at hairs, textile fibers and potassium chlorate, Epsom salts and copper sulphate.



KEEPING THE *Home* SHIPSHAPE

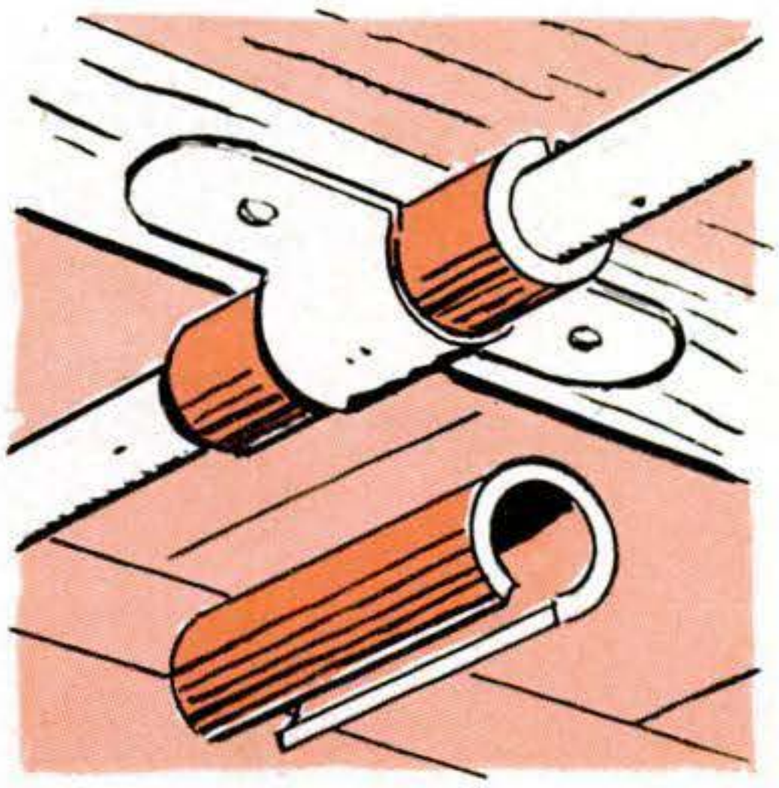


After oiling an electric fan, place a large paper bag over the wire safety cage and run the fan for a few minutes so that the bag catches any oil spatters. A very large fan can be covered with a paper garment bag, shortened to fit the height of the appliance.



Painting drawer knobs is a snap if you leave the screw in place so you can clamp a clothespin over it. This gives you an easy-to-hold handle for turning the knob as you paint.

To discourage insects from attacking you on open porches or patios, replace white lamp bulbs with yellow ones. Tests show that white beams attract 220 percent more bugs than yellow lighting.



Pipe brackets will take a tighter grip if a short piece of slit garden hose is slipped around the pipe before each bracket is mounted in place.

If mildew is a problem in an unventilated cellar closet, try washing the fungus area with ammonia. When thoroughly dry, apply a couple of thin coats of fresh white shellac.

Please turn the page for more home tips.

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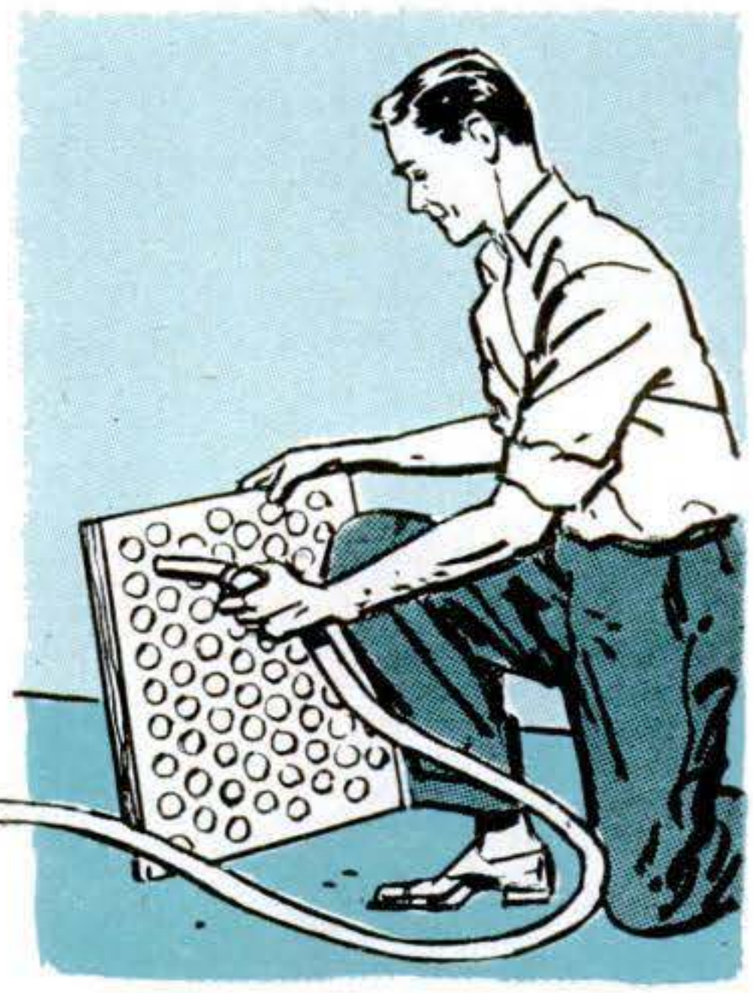
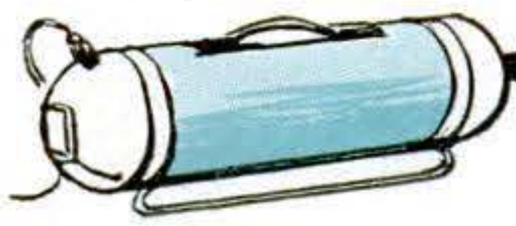
More Home Tips

To patch plaster with plasterboard, remove square of plaster, drill holes in patch cut to size, and drive flathead screws into lath to bring the face of the patch flush with thicker plaster. Push spackle behind patch to hold it in place. Then smooth off crack.

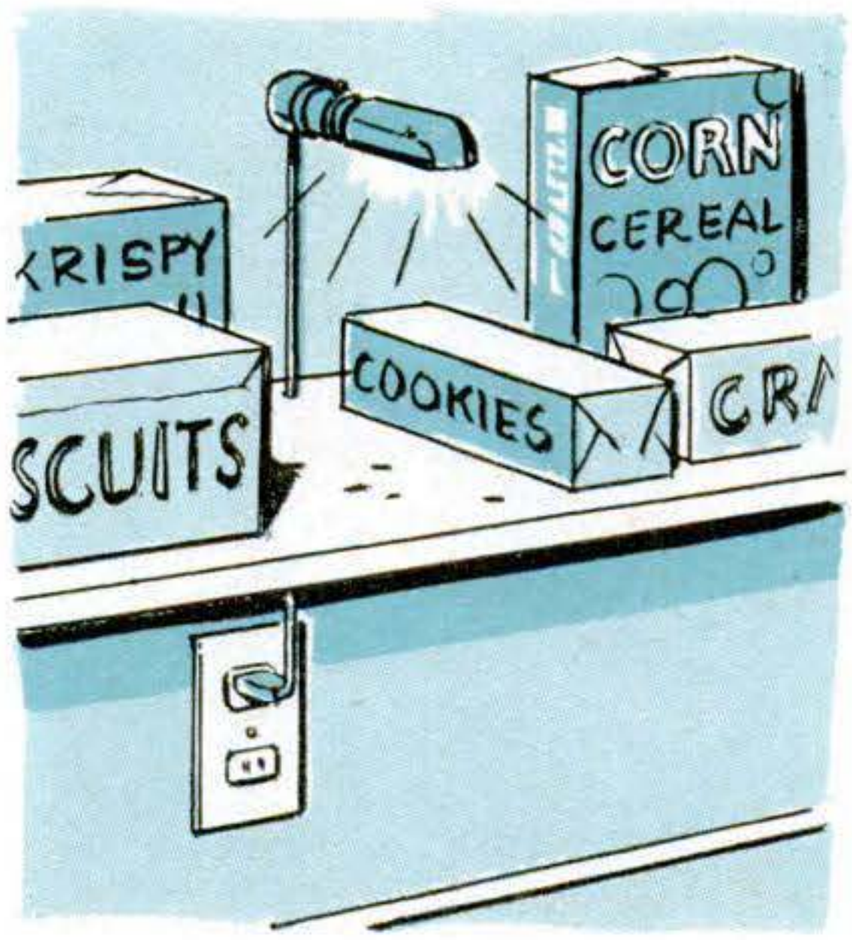
Need more ice these days? Milk cartons slit down the middle make extra refrigerator trays. For picnics, freeze ice in whole cartons. At the picnic grounds, just tear away the leakproof containers to remove the ice.



Air filters for furnace blowers can be vacuum cleaned for use another year. Just stick the nozzle in the holes and clean on both sides.



A rusted garbage can that has broken through at the bottom can be salvaged to hold dry rubbish. Upend the can, cut a tight-fitting circle of tempered hardboard and insert it in the bottom of the container.



A night-light bulb turns any drawer or cupboard shelf into a crisping bin. If you have a cabinet with an outlet nearby, bore a hole, push a wire through and attach a lamp socket. Plug in the lamp a few hours every day.

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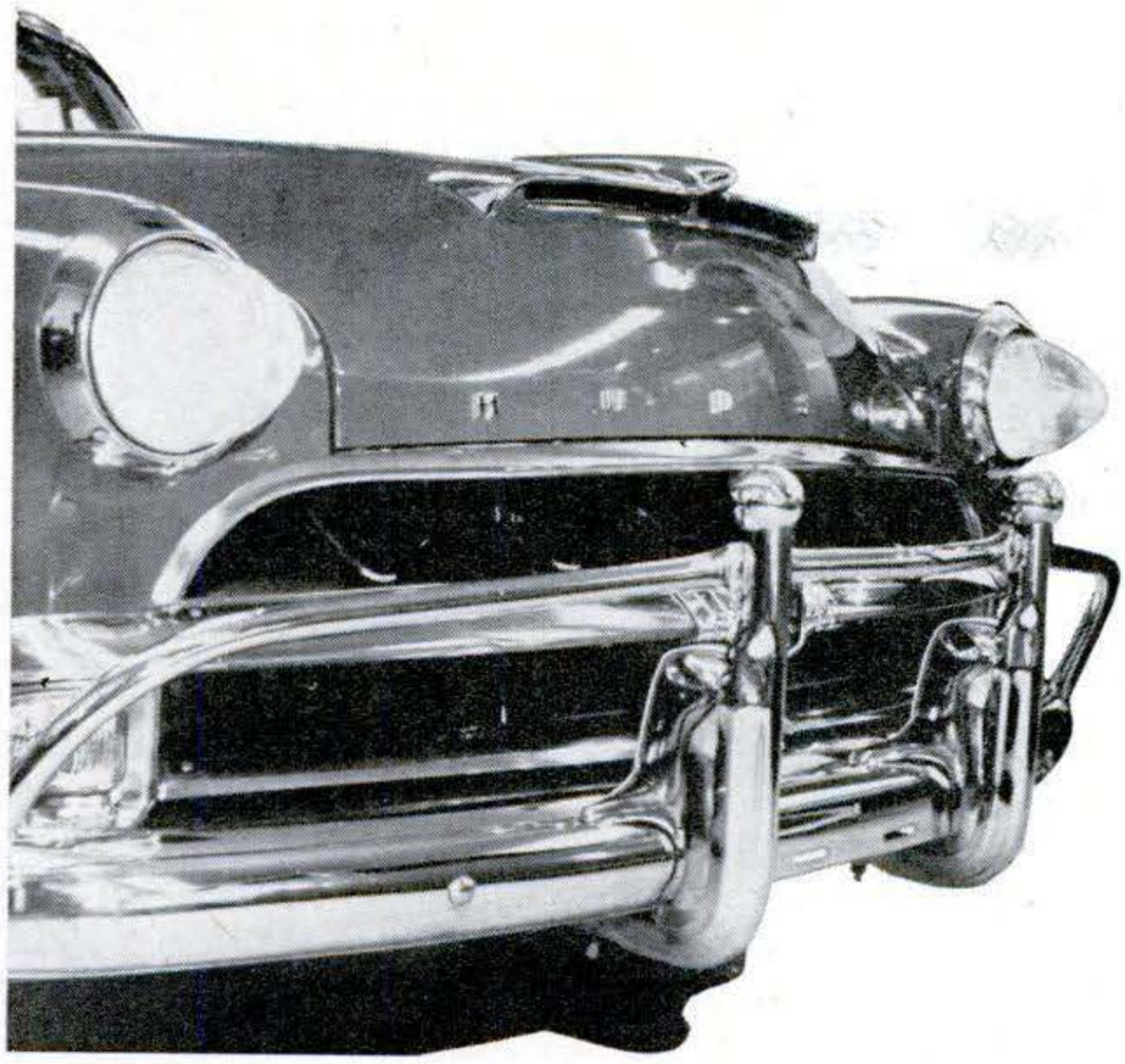
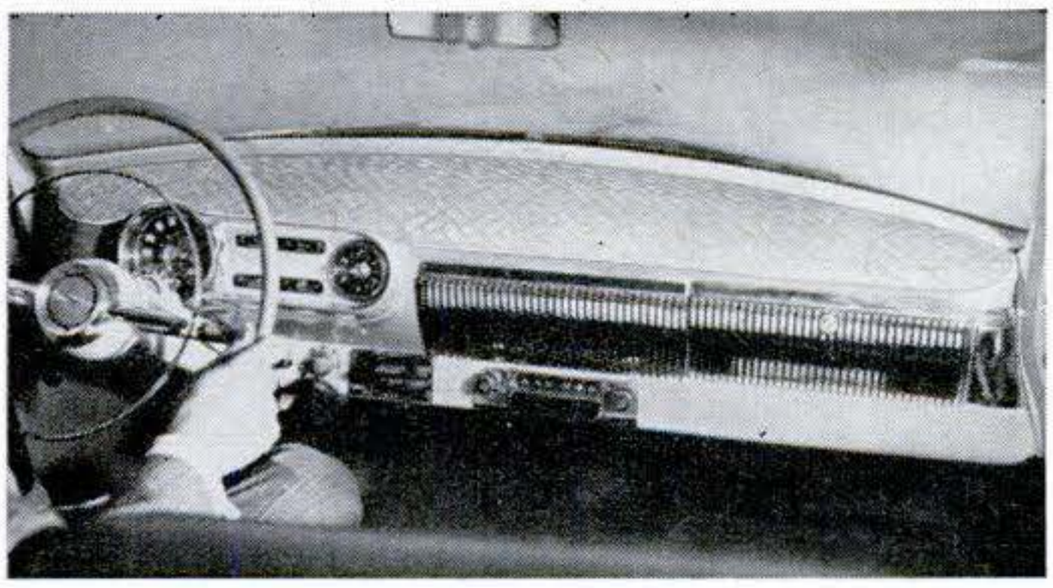
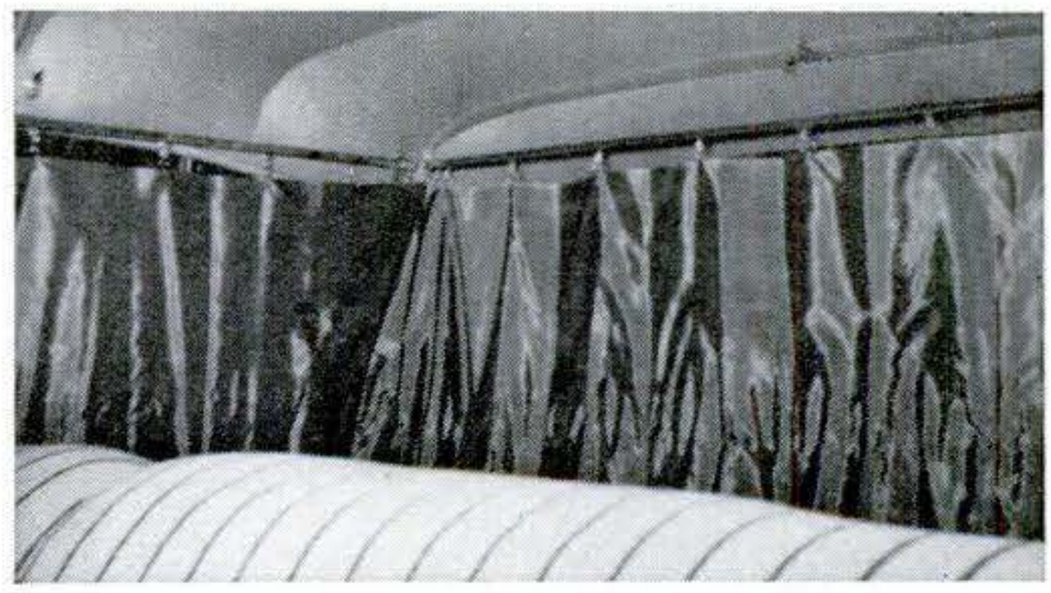
New for Your Car



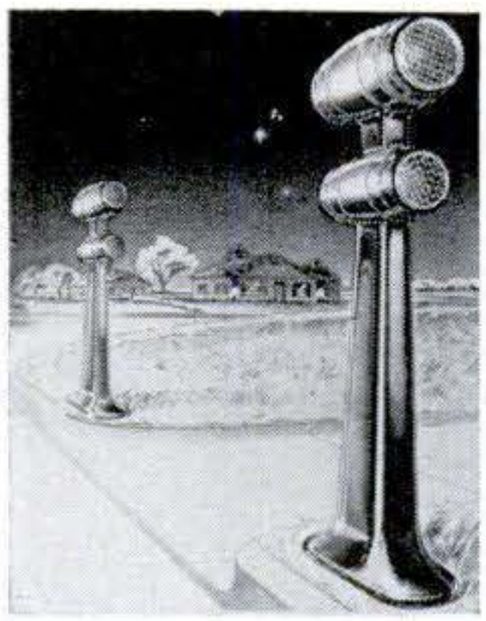
1. Plastic Lenses Guard Headlights. These lenses fit over standard headlight lenses on all cars, protecting them from dirt, stones and insects. Quickly installed under the headlight retaining ring, they add to a car's appearance and make the lights visible from the side at night.



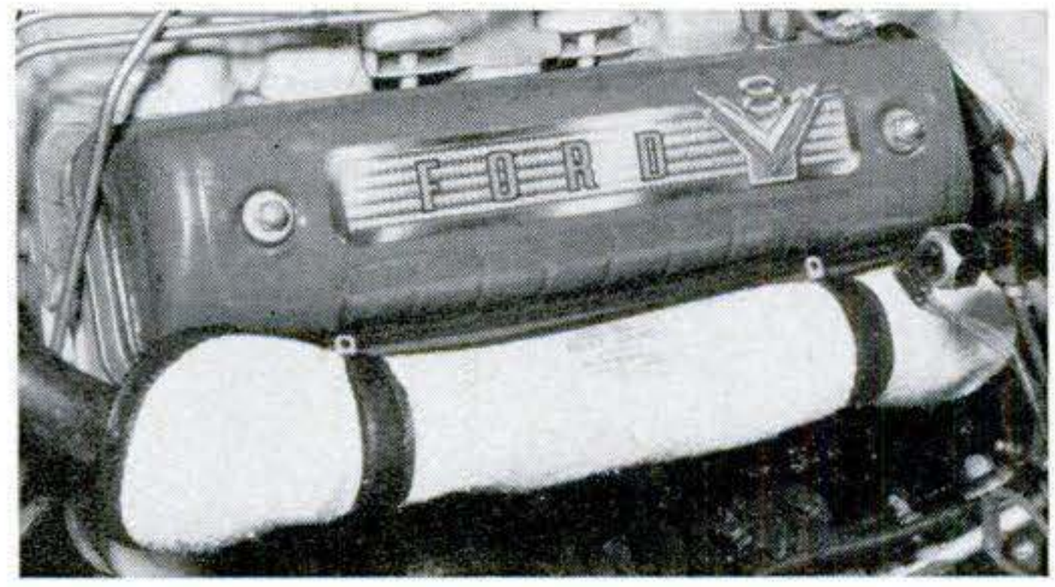
2. Crash Pad Sticks on Dash. You can install this decorative crash pad in less than a minute, simply by removing the paper from the pressure-sensitive back and pressing it in place. Aside from dressing up your car's interior, it eliminates glaring reflections that bounce off the dash. Made in a variety of colors, it is available for most late-model cars.



3. Curtains Give Privacy. Sleep in your car or change clothes at the beach in privacy by drawing these curtains to close the entire car from outside view. They slide on chrome traverse rods which are attached to the roof upholstery by large pins. The rear of the car can be closed in by transferring the front rod to the center of the car, giving the driver full vision.



4. Reflectors Outline Driveway. You'll garage your car safely at night with these 8″ chrome reflectors lining the driveway. They are sold in pairs, or the heads can be bought separately for posts.



5. Guard Protects Arms. Accidentally touching a hot manifold while working on your car is prevented by this asbestos guard, which snaps over the manifold or crossover pipe, permitting you to work freely.

Further information on these new car products can be obtained from: 1. Gaylord-Shelton Inc., 1918 S. Prairie, Chicago; 2. Cosmopolitan Enterprises, P. O. Box 2036, NB Station, St. Louis 15; 3. Auto-Cabana & Curtain Co., P. O. Box 222, Syracuse, N.Y.; 4. Cartruck Products, 3243 W. 33rd St., Cleveland; 5. Allen-Rick Co., 7925 Chase Ave., Los Angeles.

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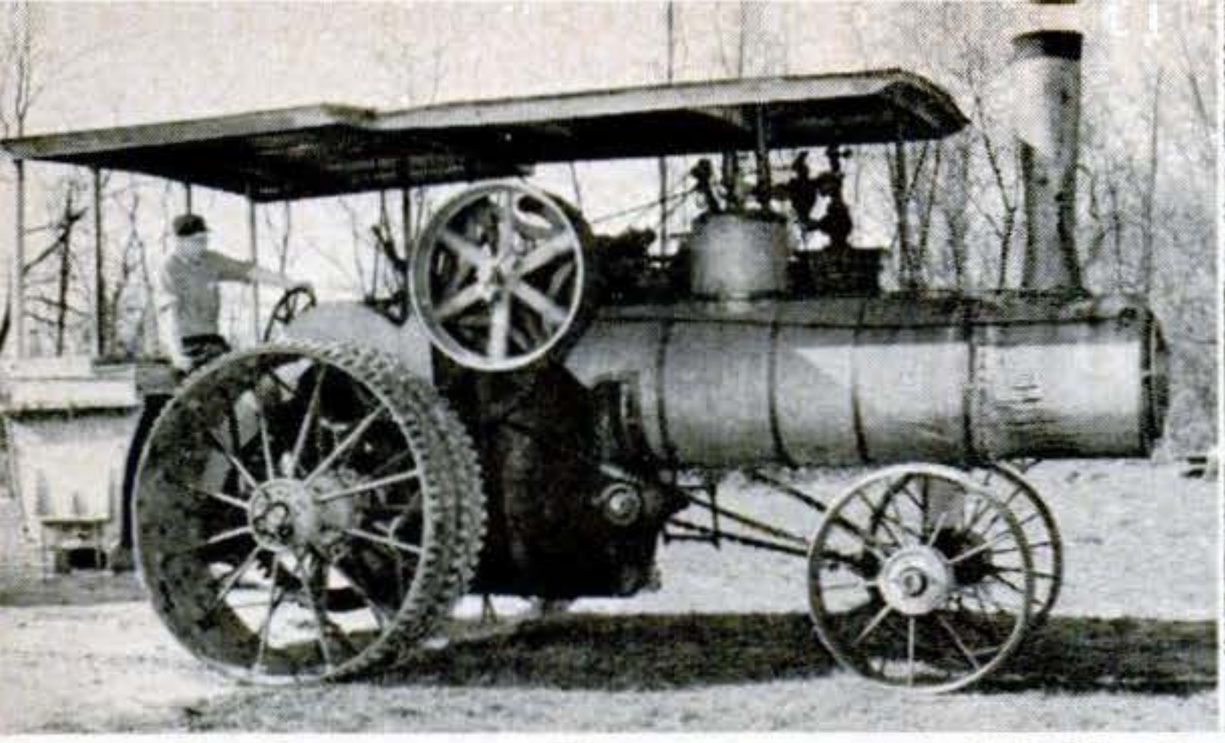
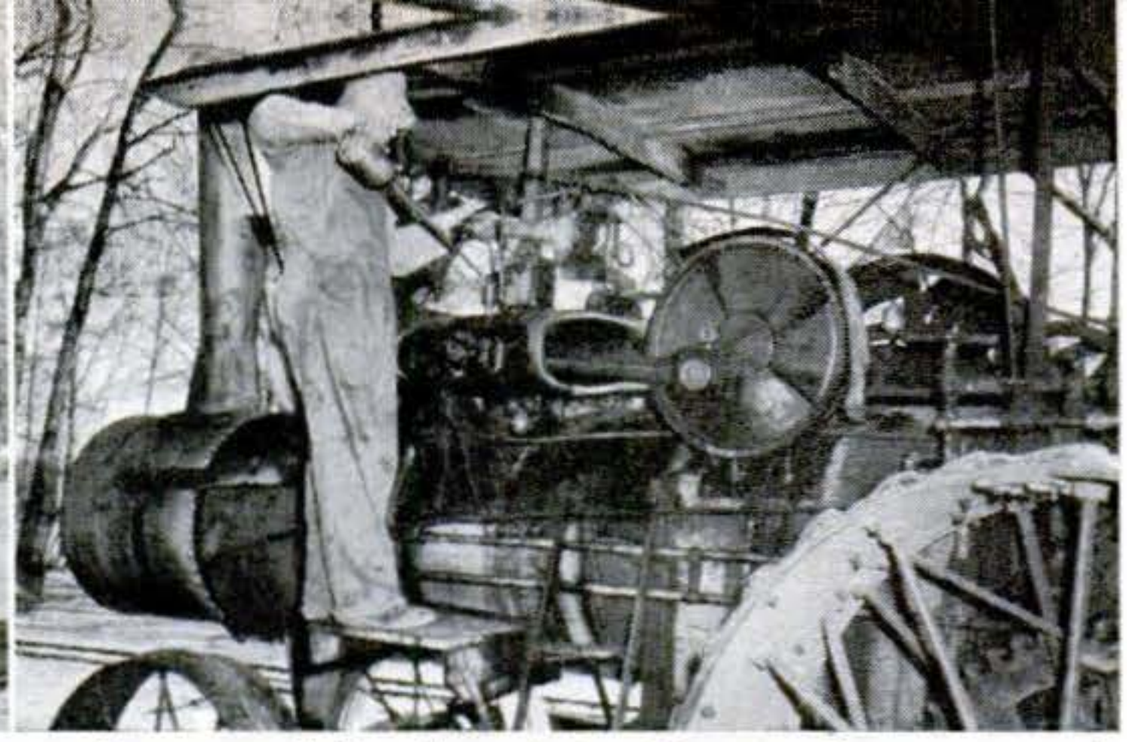
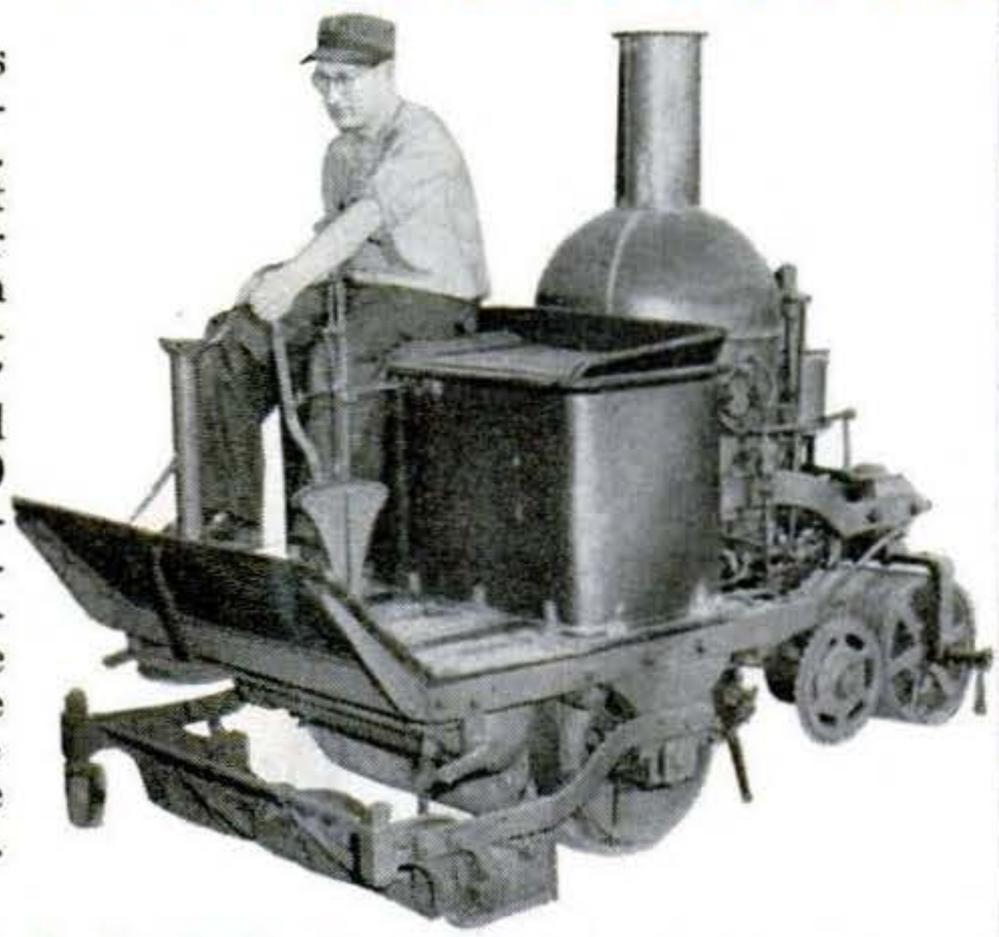




Twelve tonner. Newer than most of Willock's machines, this Baker Special steam traction engine, largest of its make, was built in 1925 by the A. D. Baker Co. of Swanton, Ohio. It has a single-cylinder, piston-valve engine, 10″ bore by 10″ stroke, that has in actual tests developed 99 brake horsepower. The flywheel (seen in photo at left above) is 38″ in diameter and 11″ wide. Drive wheels are 64″ in diameter and 24″ wide, driven at 18-to-1 ratio to put the machine on the road under its own power. The front wheels are steered by a worm-gear and chain linkage. Working steam pressure is 180 lb. per square inch.

From the gaslight era. This Crown pumping engine ran on illuminating gas. Two eccentrics worked separate valves, one to admit gas, the other opening before a small pilot flame outside the cylinder. Sucked in, this ignited the charge while the piston still traveled outward. As the gases cooled, a partial vacuum was created and atmospheric pressure drove the piston in. The pump (below the con rod) was worked by a bell crank. Air in the dome on top smoothed out pump pulsations.



Automobile lawn mower is what they called this Coldwell steam machine in 1903. It cut and rolled the grass at the same time. The big roller drove it; the small one in back steered it. A two-cylinder Mason engine of 3⅛″ bore and 4″ stroke developed 15 hp. Steam pressure of 150 lb. was automatically maintained by a diaphragm controlling gasoline to the burner. A long chain from the sprocket under the engine drove the reel. A mower like this was used on the huge lawn of the U.S. Capitol.

Engine 44 rounds the bend (right) with Willock in the cab. Built as a saddle-tank 0-4-0 by the H. K. Porter Co. in 1903, this 2′-gauge locomotive worked for years in a steel mill. Willock rebuilt it in 1945, adding pilot wheels, steam brakes, a new cab, and a tender he built himself. The cylinders, 8″ bore and 14″ stroke, have slide valves worked by Stephenson link motion. No midget, the boiler has 66 tubes 7′ long and 6 sq. ft. of fire-grate area. Working steam pressure is 140 lb.

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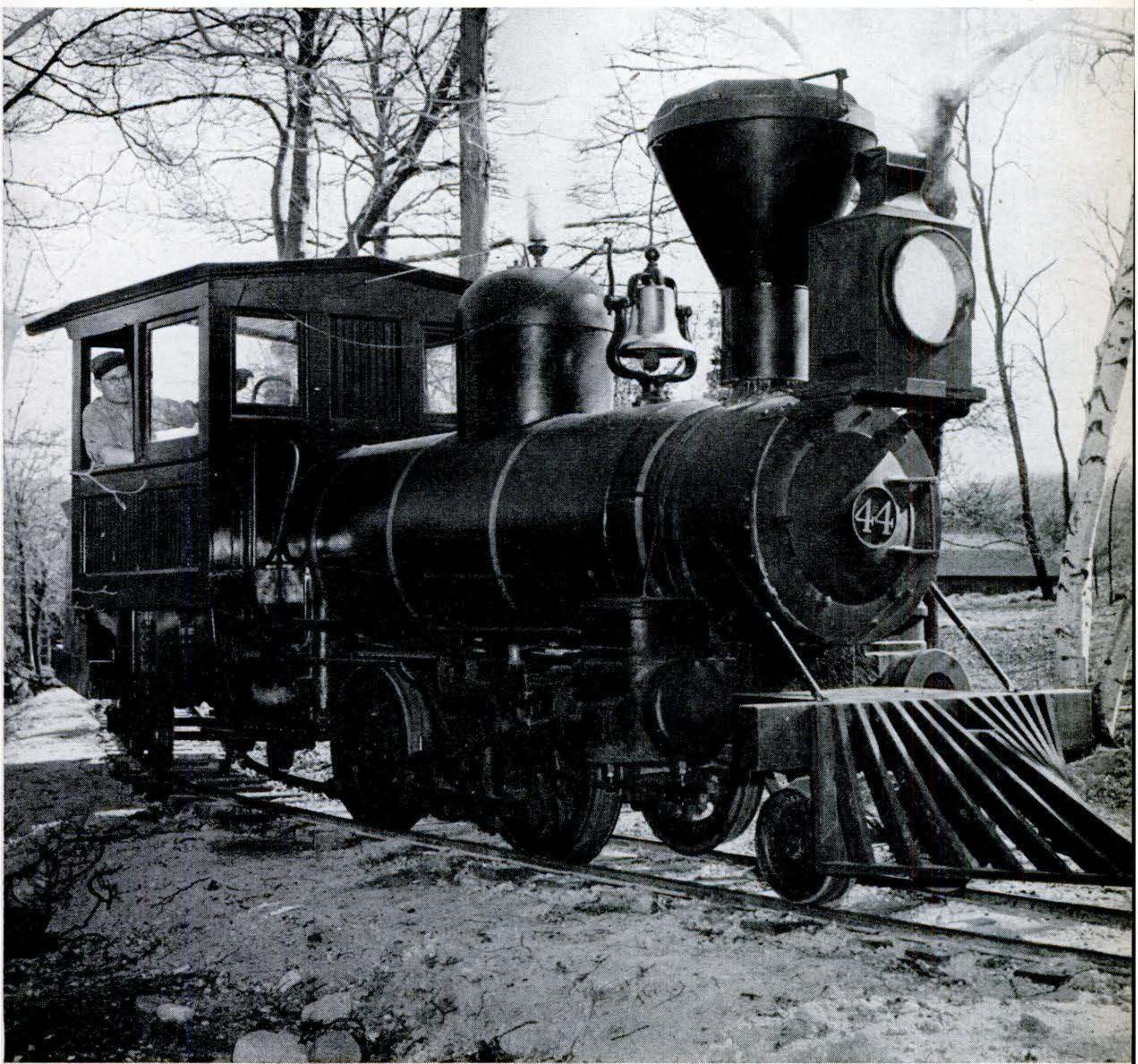
They're Old...But They Run

Antique engines stop rusting, start chugging in this expert's hands.

OUT on Long Island there is a man who likes to make old machinery tick again. Even a 12-ton traction engine is not too big for William W. Willock Jr. of Syosset. He has two steam locomotives weighing eight and 10 tons, plus track to run them on.

Among his other machines are a 2½-ton baby steam roller, two hot-air engines, various smaller power plants and a dozen antique cars—gas, steam and electric.

Restoring these old-timers is strictly a hobby. Willock, a skilled machinist, does most of the work himself with occasional help from an interested friend. Eventually he hopes to put everything he has in working order. It looks like a lifetime job. END



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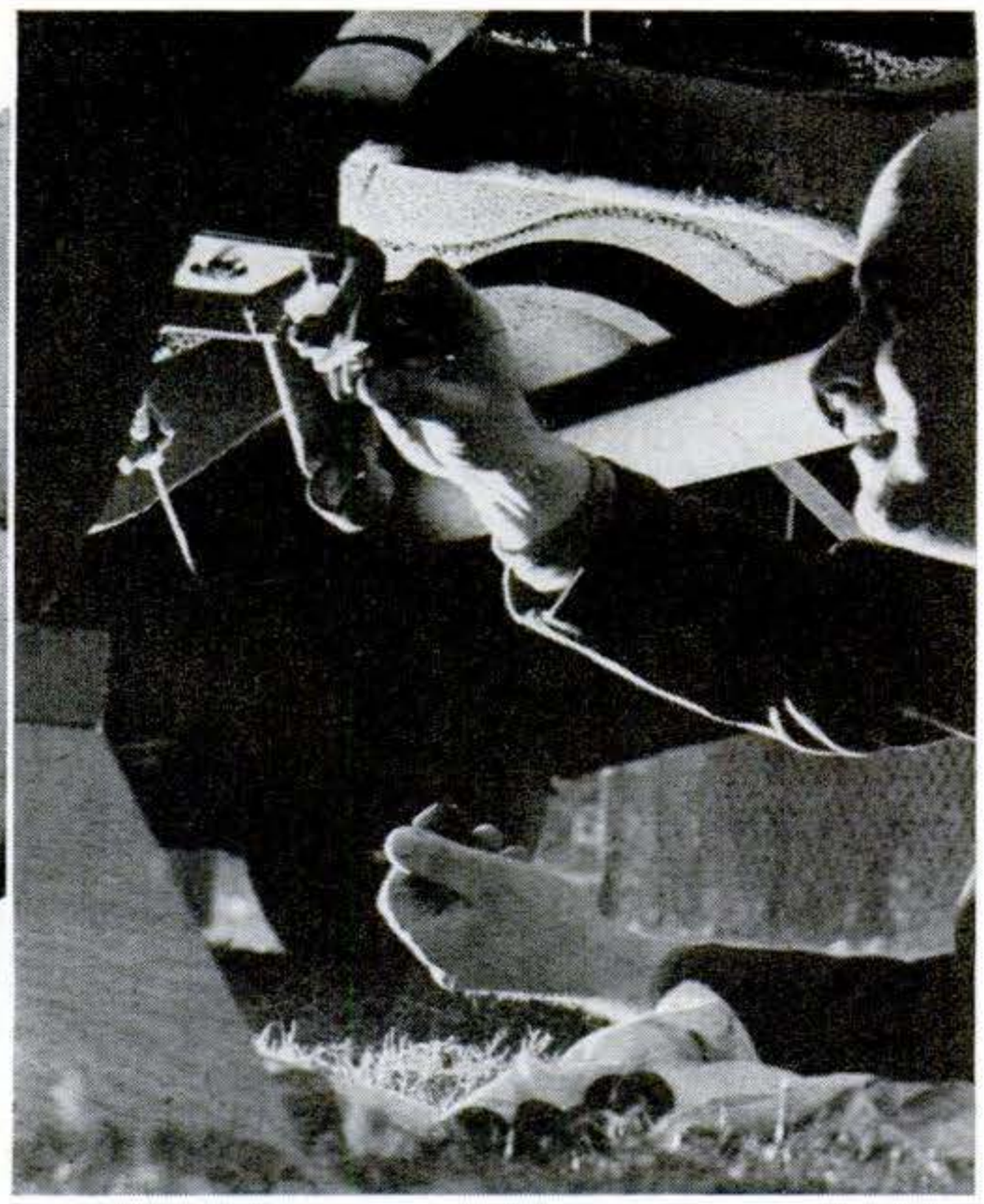


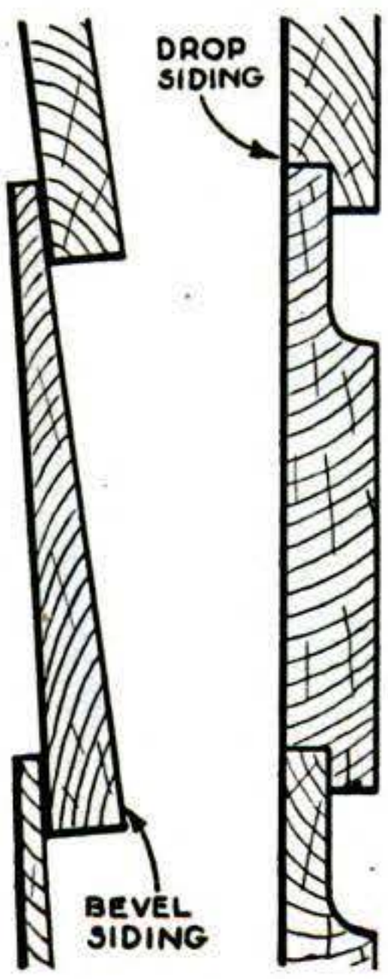
Rubber Bushings Give an Old Car a New-Car Ride

If your car has direct-acting shock absorbers, chances are that long before the shocks wear out, the little rubber bushings that keep them from rattling on their mounting brackets wear thin.

For $1.60 and an hour's time you can restore your car's ride by cushioning the shock-absorber mounts with new rubber bushings. Sixteen bushings at a dime a piece make a complete set. The difference is well worth the time and expense involved.

Installation of the bushings is a simple job. On most cars, one wrench will do it. Two types are common; a tapered bushing, which fits into an eye at the end of the shock absorber and a collar type with parallel sides, which fits over a stud on the shocks. To install either type, back off the nut that holds the metal retainers over the bushings, remove the old ones and slip the new ones over the stud. If a torque wrench is available, tighten the nuts to about 25 foot-pounds' torque. Check the shocks, too, while you have them off.

SIDING



There are two principal types of siding—bevel and drop. Drop siding is also known as rustic or barn siding. Drop usually is 5", 6", or 8" nominal width and is dressed to ¾" thickness. Bevel siding may be either the narrow type, with 3½", 4½", or 5½" face widths and a thickness of 7/16" or ⅝"; or the wide type, 7¼", 9¼", or 11¼" wide and 7/16", 9/16", or 11/16" thick.

Bevel siding normally is lapped ¾" with the 3" width, 1" with the 6" width, and 1½" in the greater widths. The lap with drop siding is from ¼" to ⅜", depending on the pattern. The lap, combined with the difference between the actual and nominal dimensions, makes it necessary to use from 123 to 145 surface feet of bevel siding and from 114 to 128 surface feet of drop siding for every 100 square feet to be covered. The amount needed depends on the width—wider siding goes farther.

Bevel siding normally is made in select grades of white pine, ponderosa pine, spruce, western red cedar, cypress, or redwood. In addition to these woods, drop siding is sometimes made in select and in sound, tight-knotted grades of southern yellow pine, Douglas fir, and hemlock.

FOR YOUR *POPULAR SCIENCE MONTHLY* INFORMATION FILE

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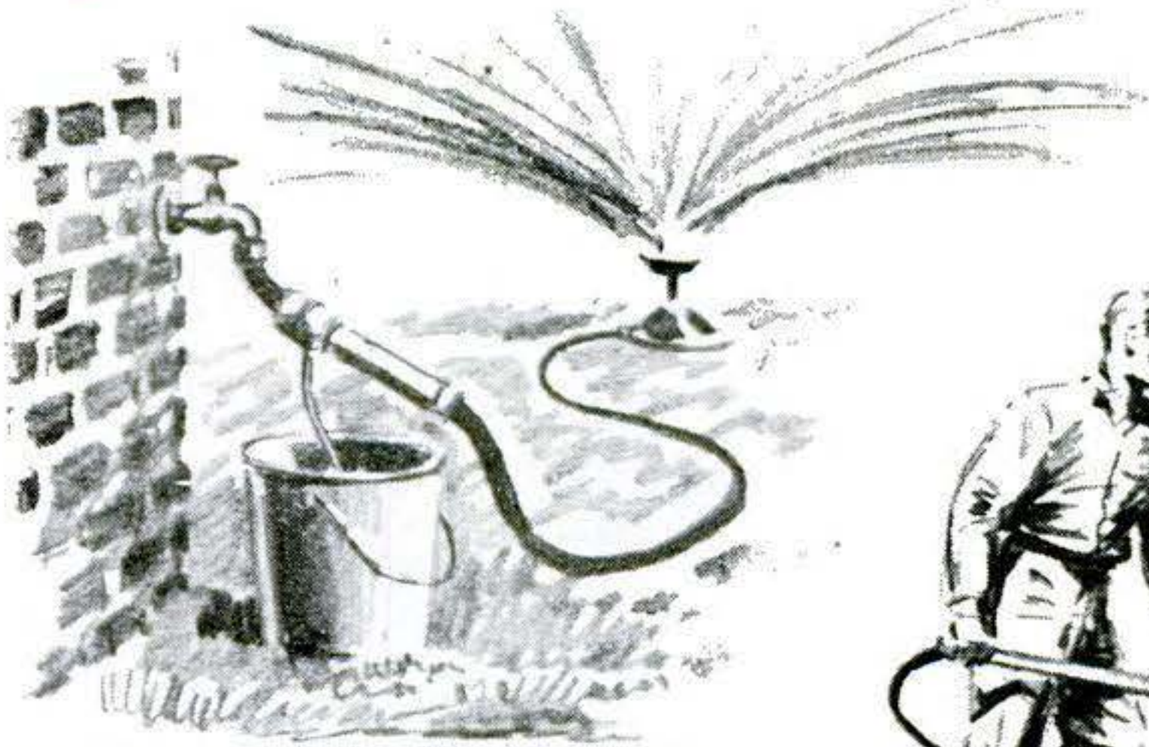
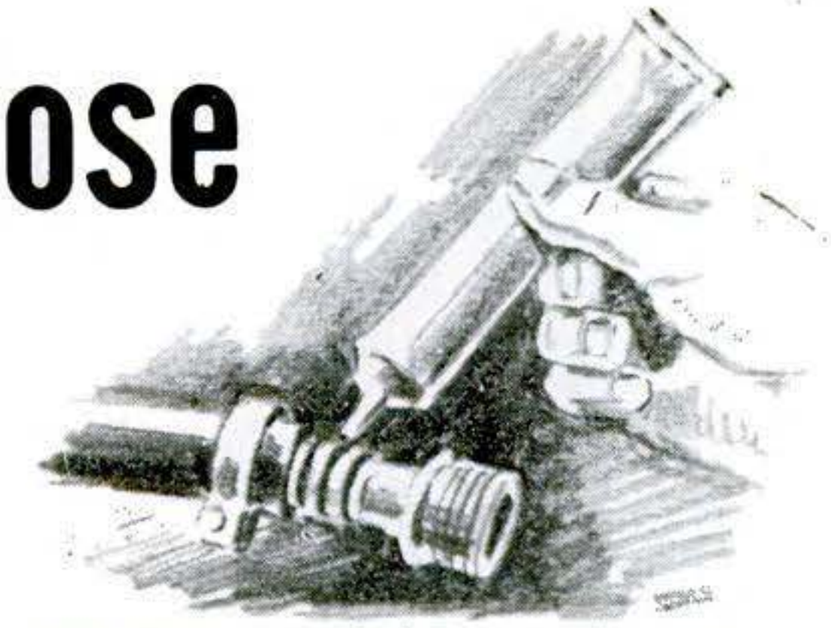
9 HINTS ON Garden Hose

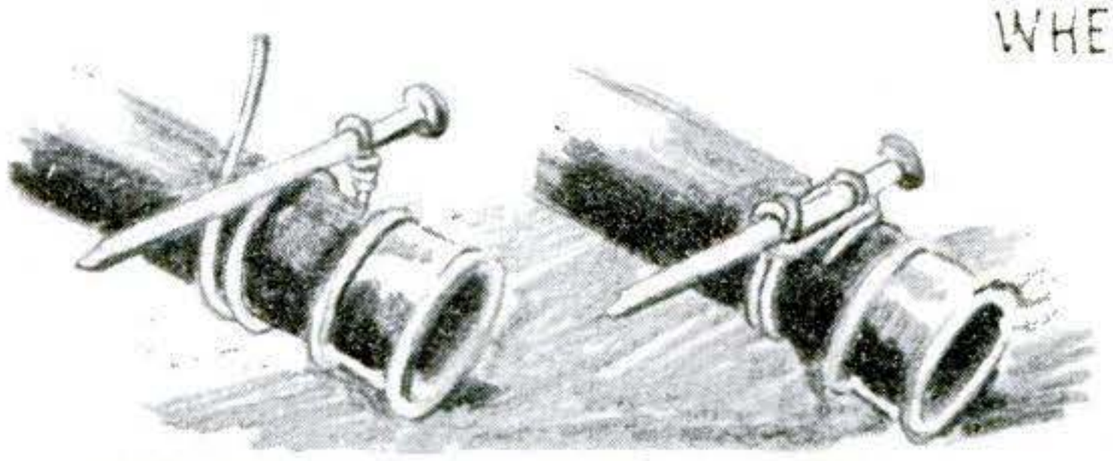


SPREAD LIQUID FERTILIZER
THE LAZY WAY. USE SIPHON ATTACHMENT WITH SPRINKLER

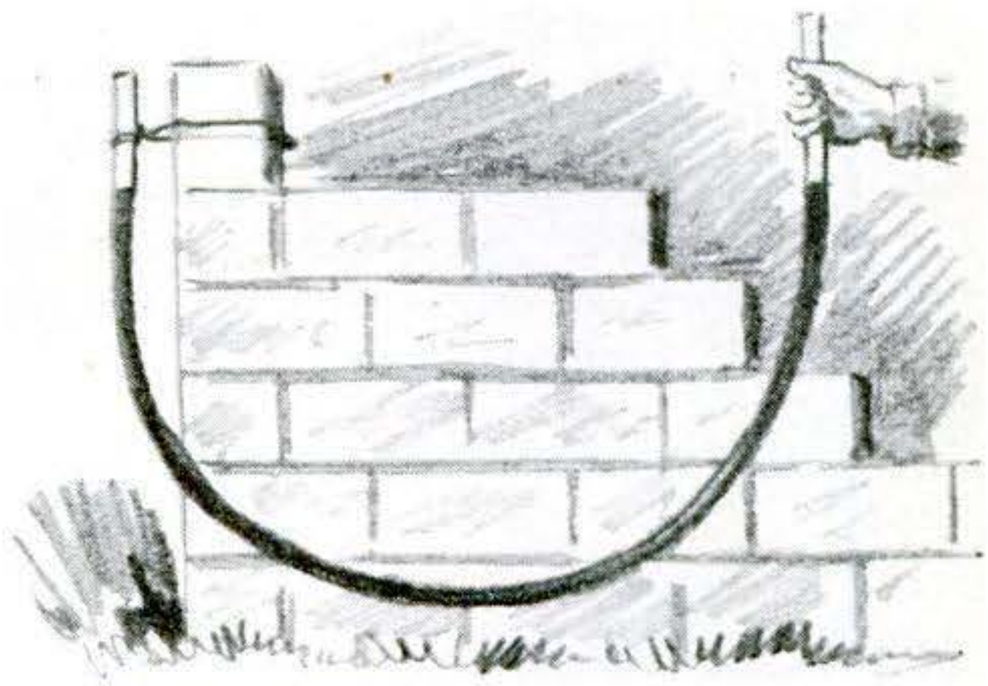


TO FIX LOOSE COUPLING
PULL IT OUT, WRAP WITH RUBBER BANDS, ADD AUTO-TOF SEALER, RECLAMP IT

WHEELED CART ROLLS SPRINKLER ANYWHERE

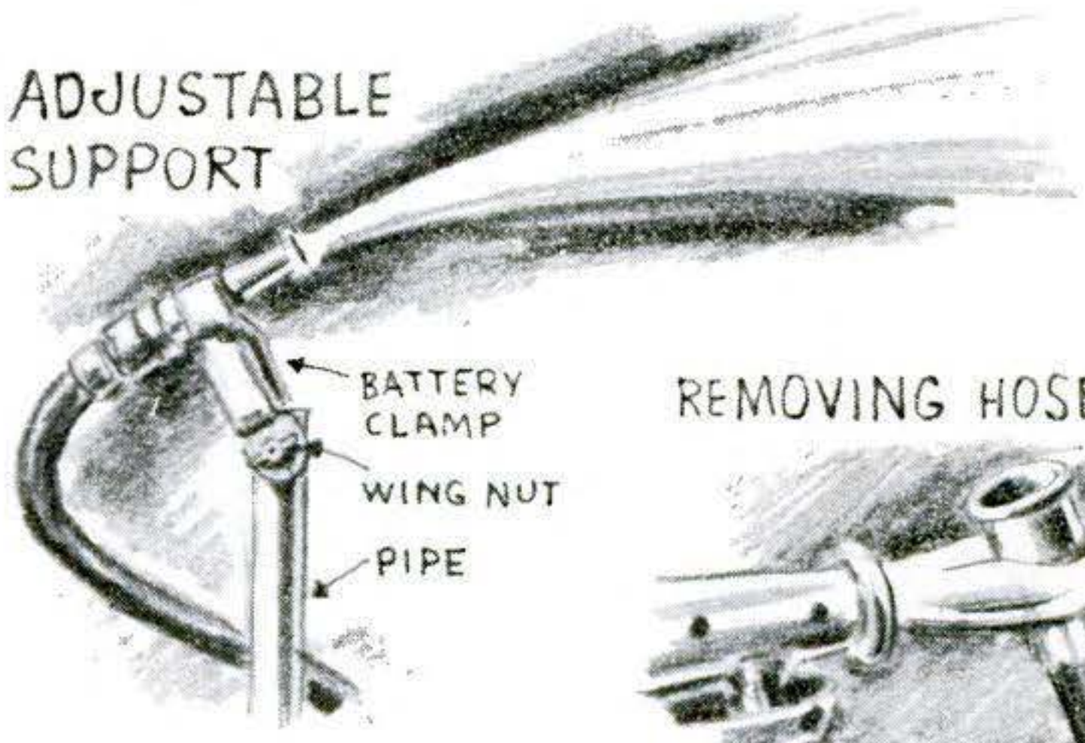


TEMPORARY HOSE CLAMP
USING SPIKE AND WIRE



AS A WATER LEVEL USE CLEAR-PLASTIC HOSE AND ADD BLUING TO WATER

ADJUSTABLE SUPPORT

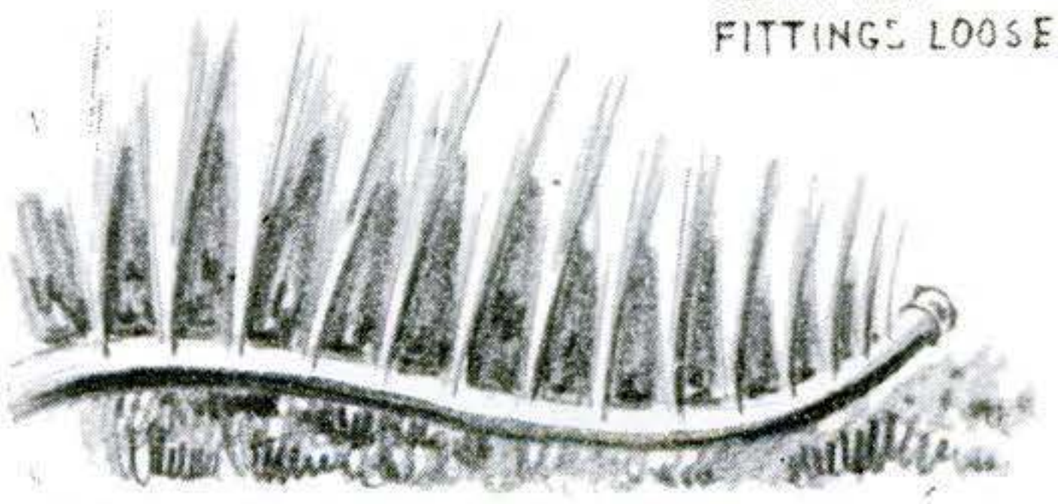


REMOVING HOSE CONNECTIONS FOR RE-USE

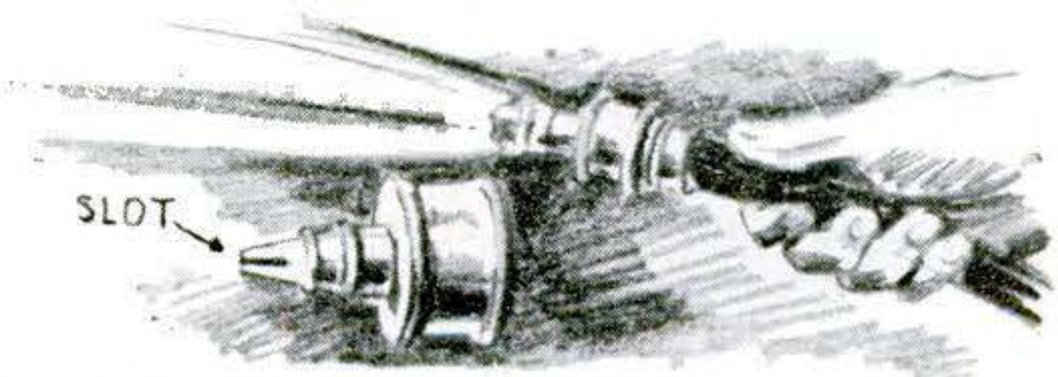
BURN THE FITTINGS LOOSE

FOR FERRULE TYPE FASTEN WITH CLAMP

FOR CLINCHER TYPE – PRY UP TABS, AND CLINCH IN HOSE



FOR A SOAKER HOSE, PUNCH PINHOLES ALONG ONE SIDE OF OLD HOSE WITH ICE PICK AND PLUG END



TO MAKE EXTRA NOZZLE, USE FEMALE PART OF OLD COUPLING - CUT SLOT IN END AND FLATTEN

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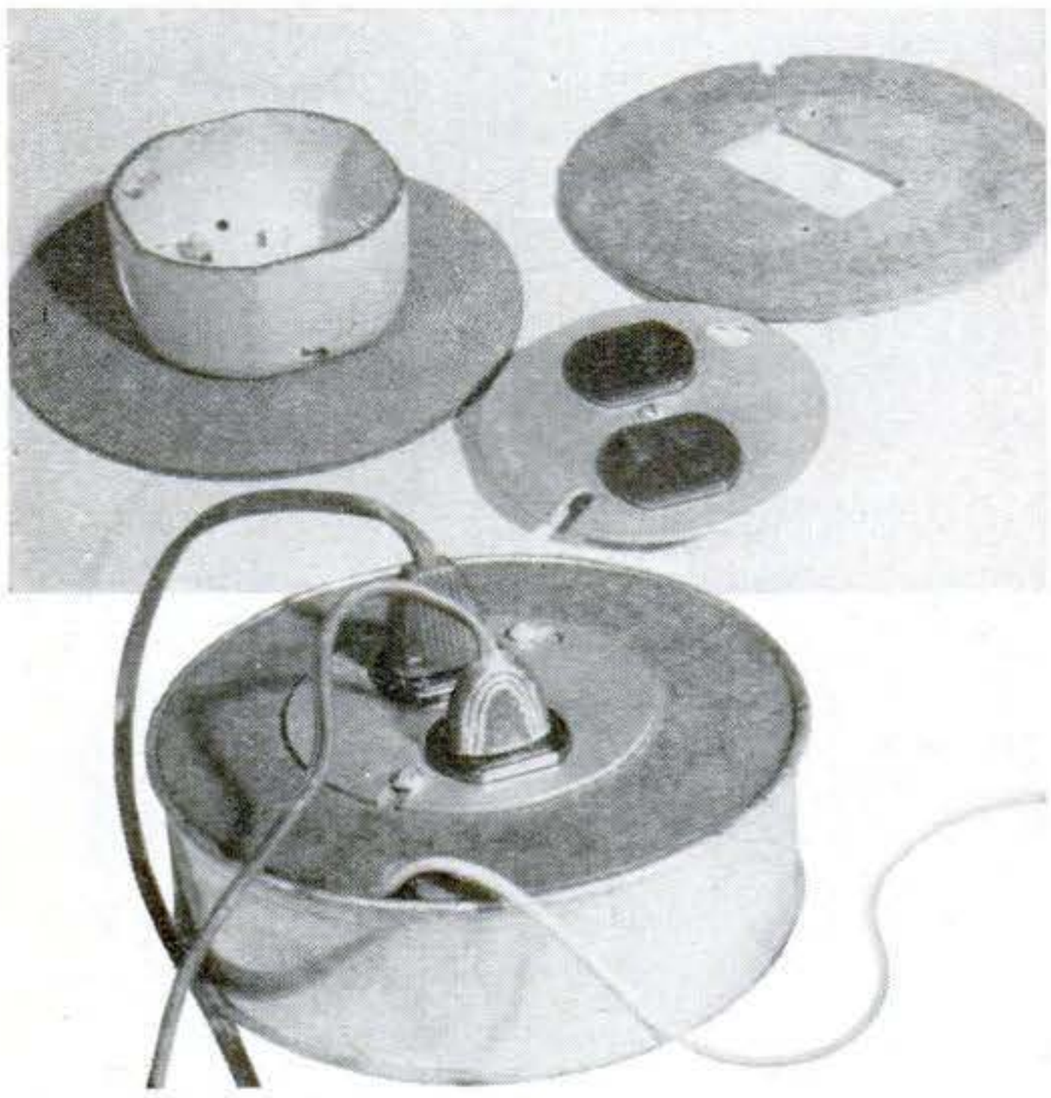
Beans Climb Sunflower Stalks

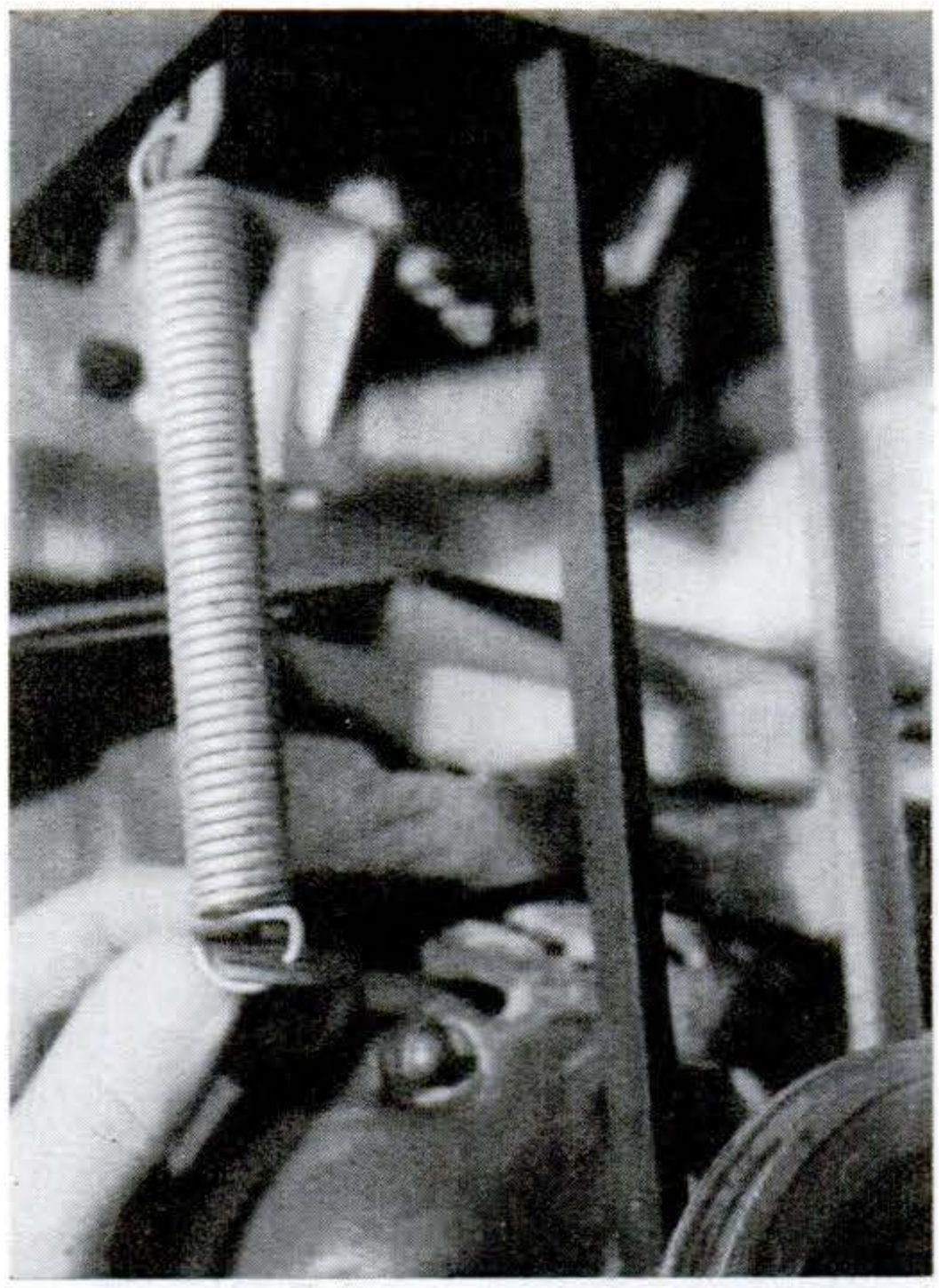
For four years I have saved myself the job of cutting and setting up stakes in my pole-bean patch. About 10 days before planting the beans, I put in sunflower seeds. As soon as these sprout, I hasten to plant the beans.

The sunflowers grow in a hurry, while the beans take their time winding around the flower stalks. This yields two crops, for the sunflower seeds make good feed to give the chickens during the winter.—*John Krill, North Lima, Ohio.*



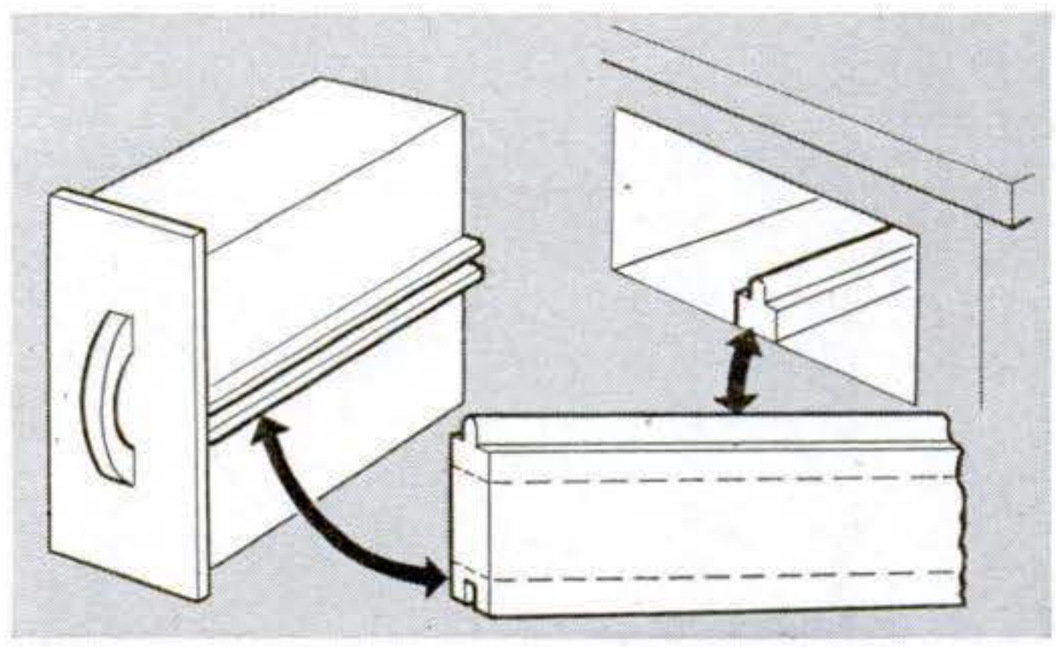
Spool Holds Extension Cord

Bolt two 6″-diameter hardboard disks to a metal 3″ double-outlet box and wind a long extension wire on it when not in use. Cut down a tin can of suitable diameter, to fit over the disks and keep the wire neatly wound.—*John M. Avery, Dexter, N. Y.*



Spring Saves Wear on Bearings

Most table-saw motors are mounted on a hinged base so that the weight of the motor keeps the V belt tight when the saw arbor is raised or lowered. Install a spring between the motor and the saw table to share the weight with the V belt and relieve the armature-shaft bearings of some of the burden. The spring should not support enough of the motor's weight to make the V belt slip—just enough of the weight to lighten the side load on the bearings.—*Glen F. Stillwell, Manhattan Beach, Calif.*



Drawer Gets Tongue and Groove

A piece of tongue-and-groove hardwood flooring, ripped lengthwise, provides two matched parts for a drawer guide. Nail the parts in place as shown and sand off the tongue to an easy sliding fit.—*Norm Jacky, Fond du Lac, Wis.*

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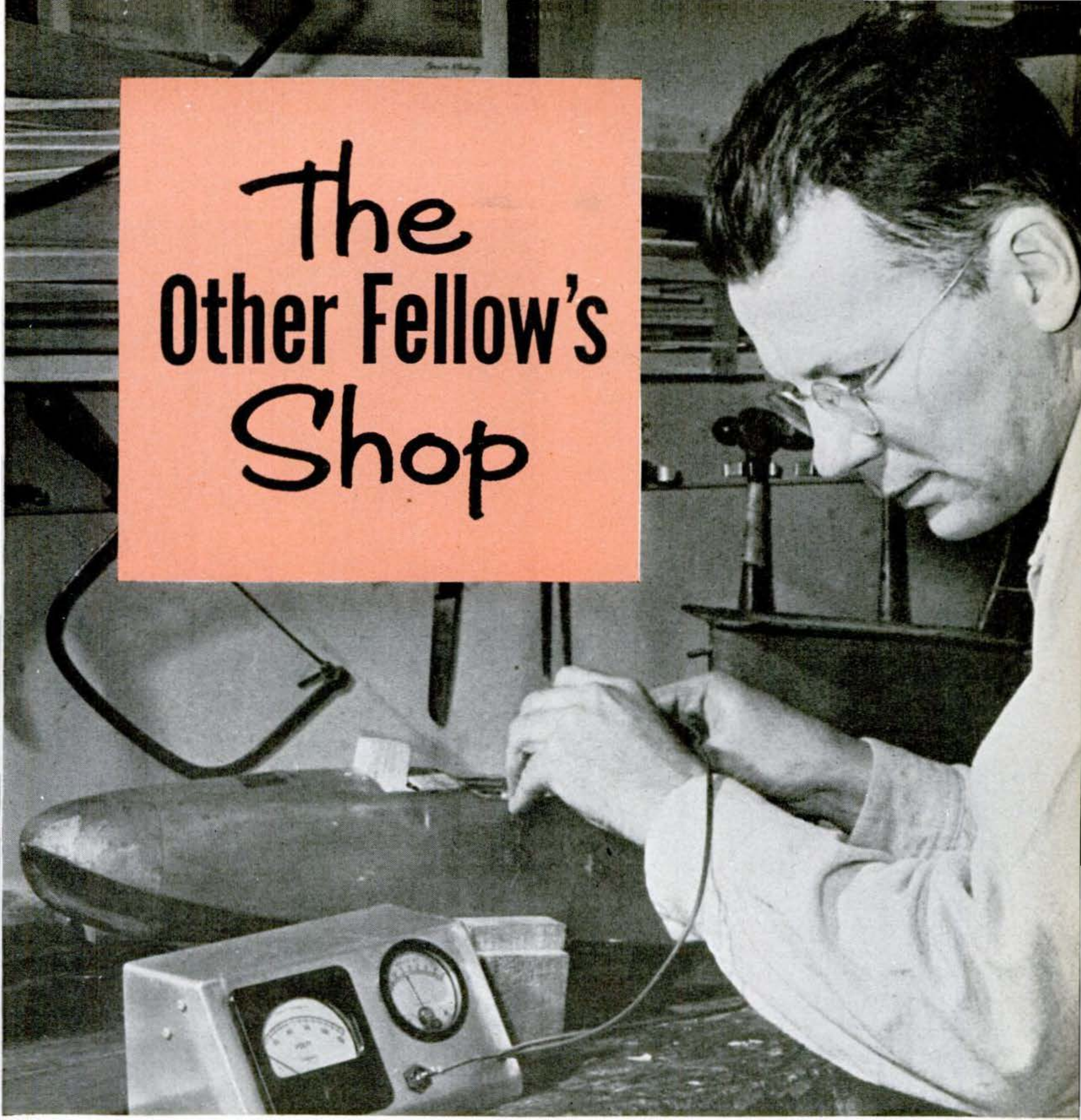


The Other Fellow's Shop

Henry Struck's hobby is flying model planes, but it takes a lot of groundwork in his shop before they can take off.

By Herbert O. Johansen

IT TAKES two workshops to enable Henry Struck, 38-year-old aviation enthusiast of Hamburg, Conn., to indulge in his main hobby of flying powered model planes. There is a "brawn" shop, which includes power tools; and a "brain" shop, in which he designs the models and builds cardboard mock-ups of new, experimental types.

These twin shops are the birthplaces of Struck's prize-winning, radio-

controlled airplanes. The brawn shop has crowded his one car out of his two-car garage. But before the tools begin to buzz there, he spends many hours at his drawing board in his "brain" shop.

If the board is sometimes thumbtacked with plans for a desk, chair or cabinet, that is to appease Mrs. Struck.

The Struck workshop is far from fancy, but it has the basic power tools he needs to "chop up wood, cut it to the right shapes and drill holes in it." It's a growing shop, though. Struck now has a 10″ tilting-arbor circular saw, a 12″ bandsaw, a 14″ drill press, a 2½″ belt sander, electric hand drills, a bench grinder, and an air compressor for spray-painting.

As yet he has no lathe. One reason is that the shaping of delicate balsa-wood parts for model planes is razor-blade craftsmanship. In fact, Struck could build his models without power tools, but they enable

This is the third of a series of articles about outstanding home workshops, from which everyone who has a shop may pick up a few helpful pointers.

See POPULAR SCIENCE MONTHLY *next issue for a story on another fellow's shop.*

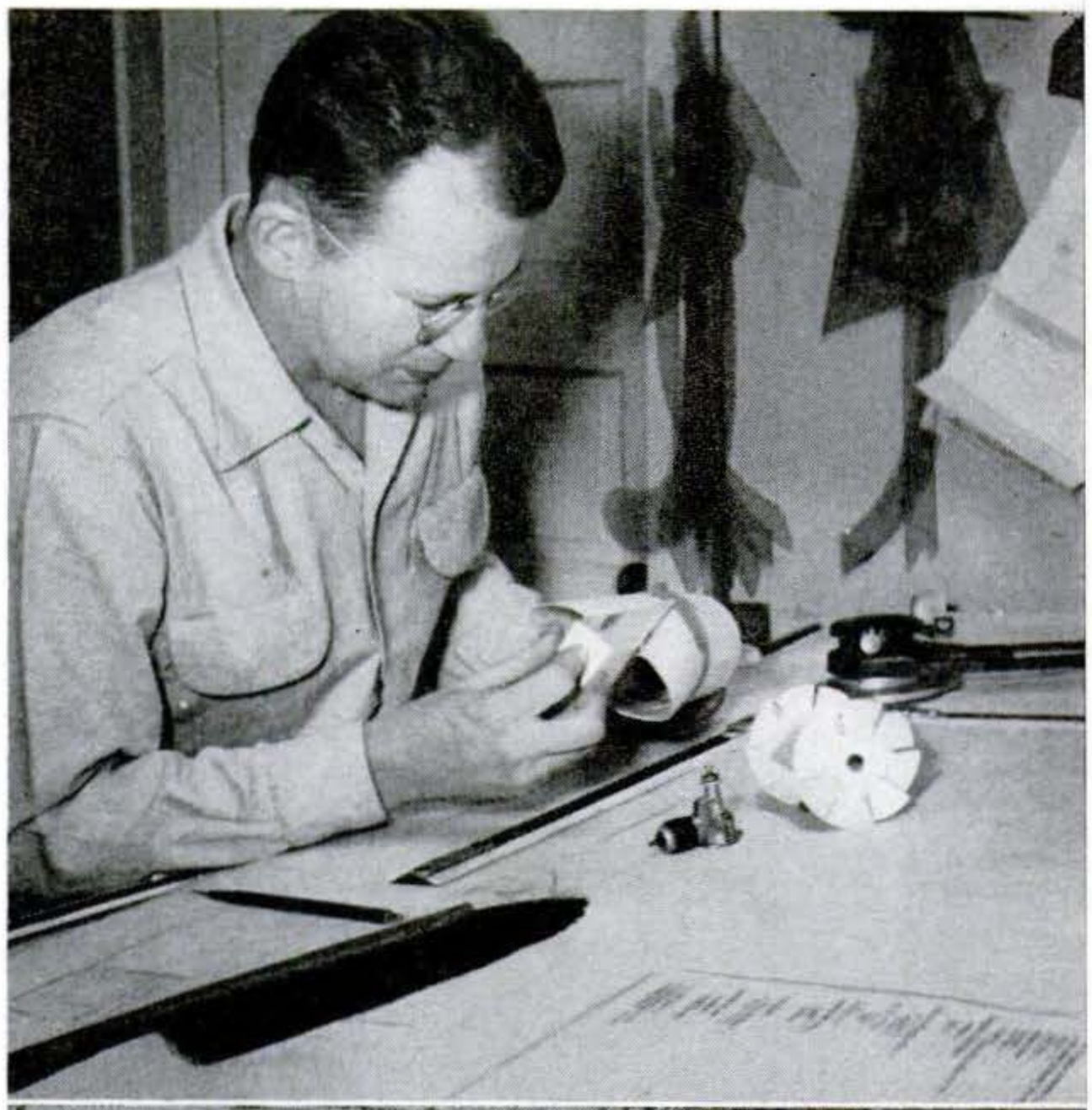
him to do it more quickly and easily, giving him more outdoor flying time. It's important, too, for him to have the right piece of balsa wood for each part of a plane. Buying small pieces and then discarding them if they aren't quite right is costly. With power saws he can buy the wood in large blocks and chop them up until he gets just the right piece.

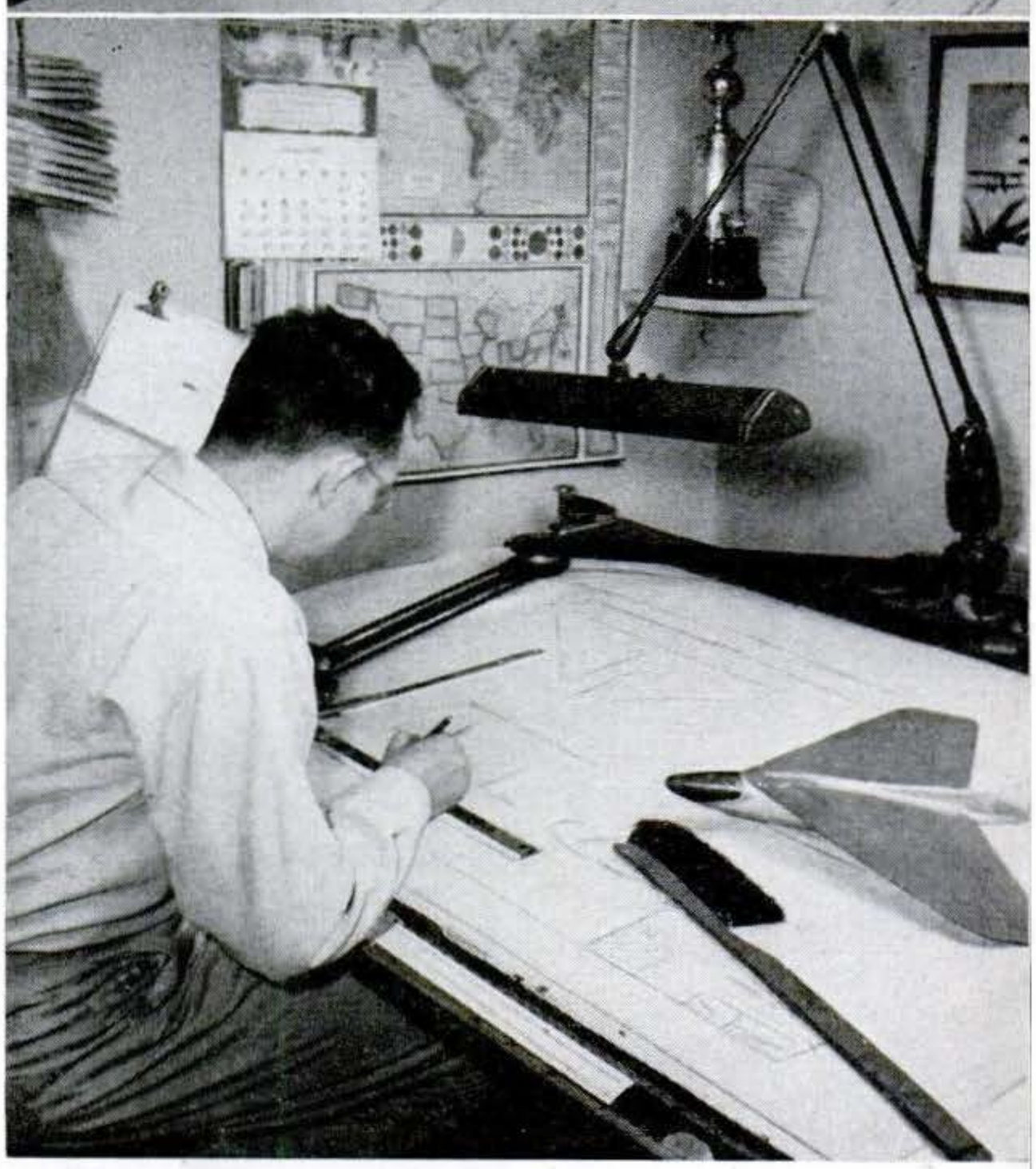
Struck's workshopping and plane flying have to be squeezed into nights, Sundays and holidays because he works six days a week for the Chalker Manufacturing Co., in nearby Clinton, as an engineer-designer on precision sheet-metal fabrication. He has had no formal engineering training. "Drawing and working with tools just came naturally to me," he says.

It all started with a fret saw that a friend of his family gave him when he was about eight years old.

"To get some fun out of it," Struck recalls, "I learned to do delicate, almost embroidery-like woodwork. I would soak the

Keeping pace with the progress of aviation, Struck designs and engineers new types in his "brain" workshop. Below, he is shown holding a cardboard mock-up of the air intake and fuselage of a jet-type plane. Rotors and engine that will turn them are on the table.





A drafting machine, shown in use above, is an important brain-power tool in designing planes and the occasional piece of furniture that keeps Mrs. Struck happy with his hobby. Above the cleanup brush is a swept-wing job that is powered by a miniature rocket engine.

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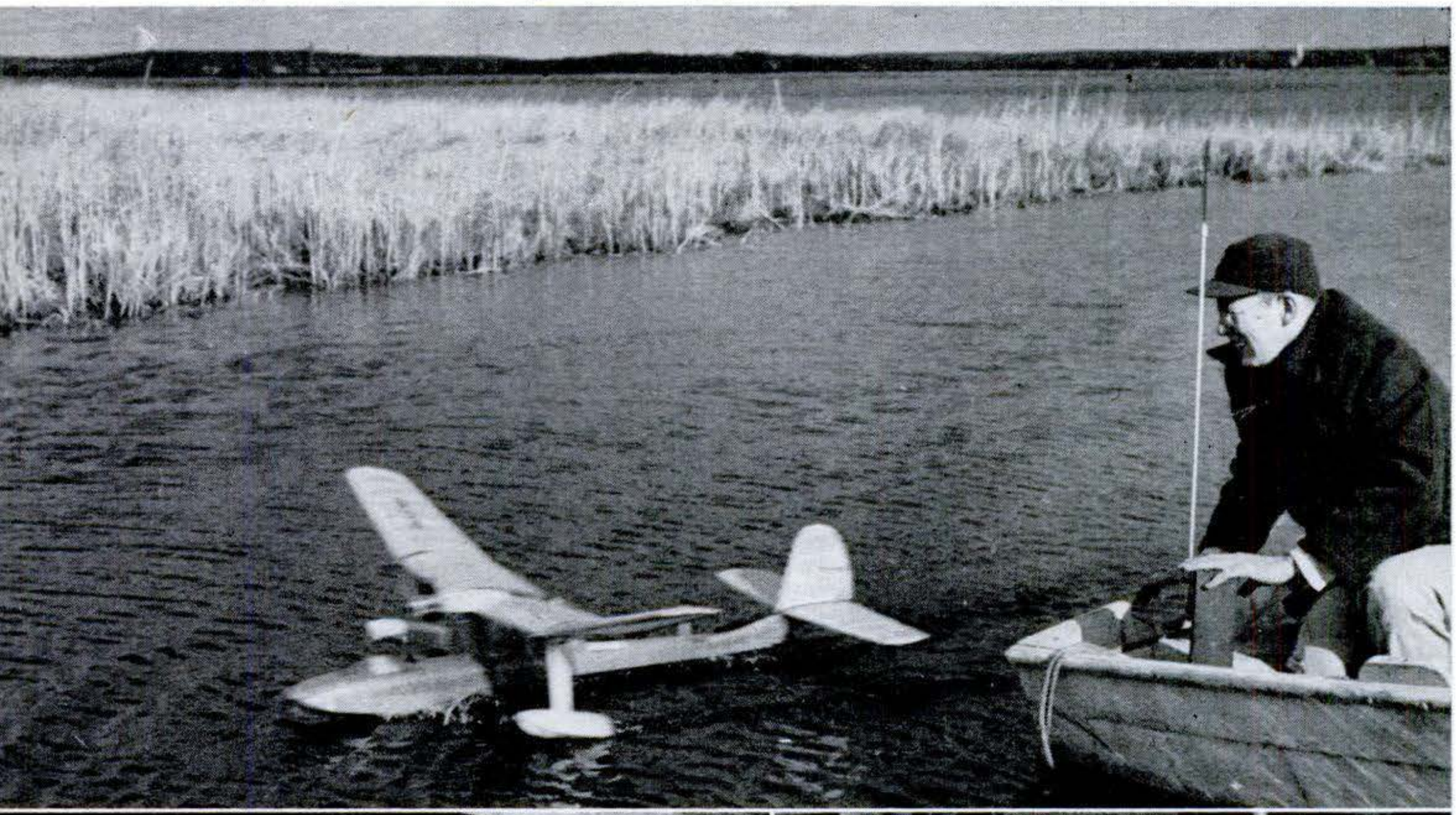
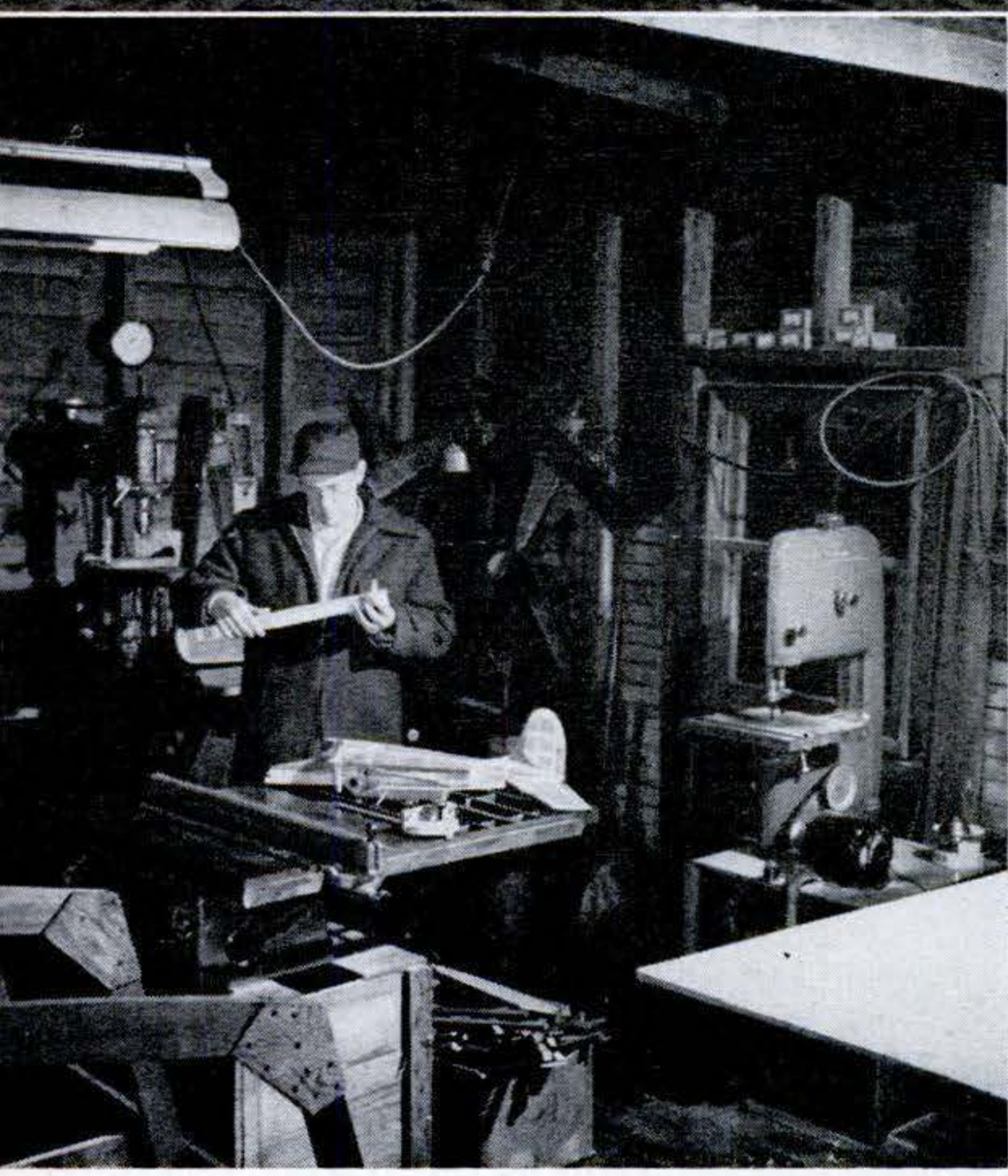
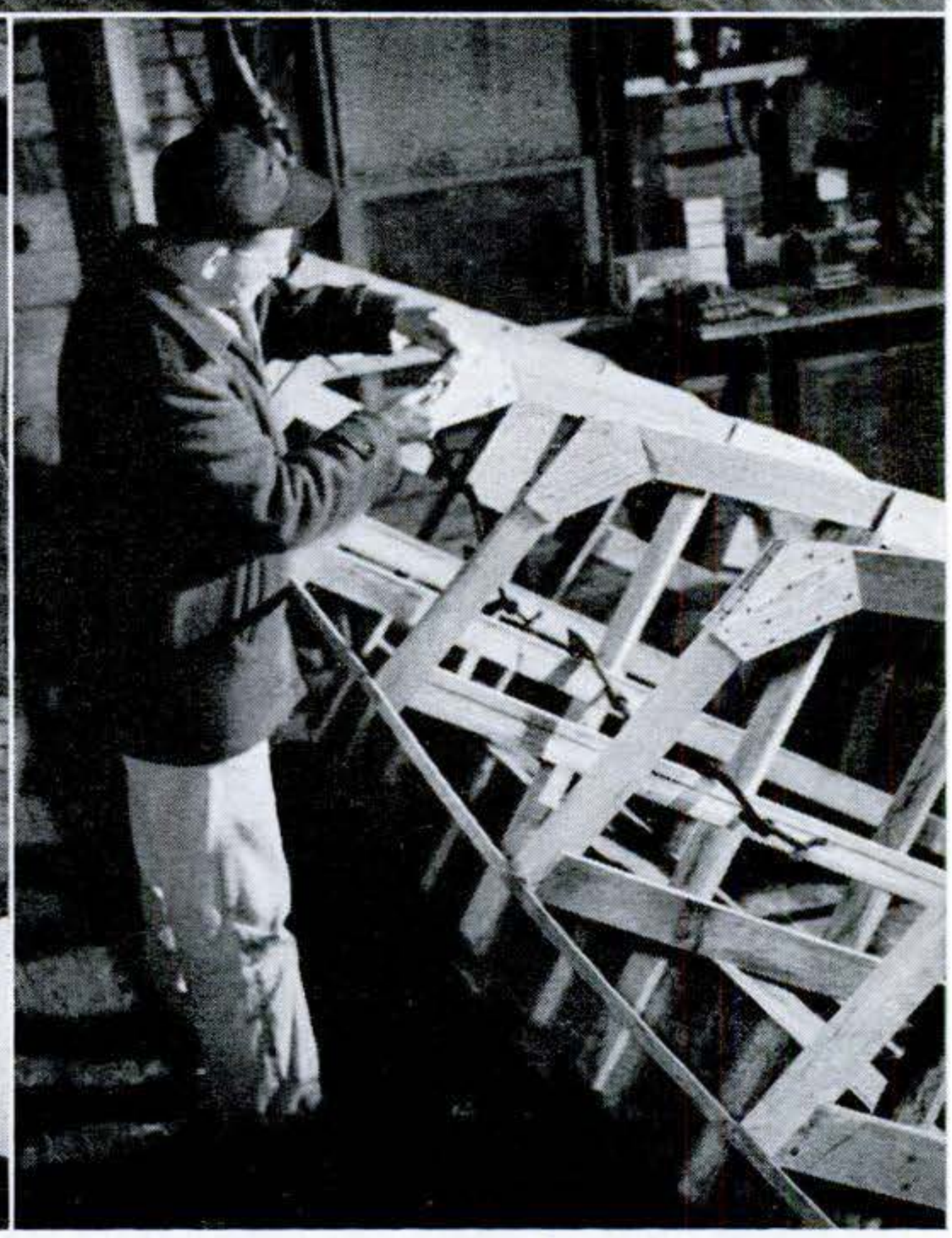
Flying the model planes is Struck's real hobby and the reason for his build-them workshop. His Hamburg, Conn., home has plenty of water around for the take-offs and landings of his favorites—seaplanes, like the Seacat he is shown launching. A radio-controlled prize winner, it is 44″ long and has a wing span of 68″. This model once made an international flight across the Detroit River, from Detroit, Mich., to Windsor, Canada, carrying air-mail letters. It has survived several "forced" landings that sent it back to the shop for major overhauls.





Stepping into his garage workshop, Struck changes clothes and jobs—from a design engineer to a plane-building craftsman. Here he is shown measuring a piece of balsa wood to replace a damaged longeron on a plane that has been crippled in an emergency landing.



Building a boat is simplified by an ingenious rig Struck devised so that the framework can be tilted to comfortable work angles. The tilt rig is a 14′-long by 1′-square plywood box to which uprights are nailed, supporting the stations, or ribs, of the boat during construction.

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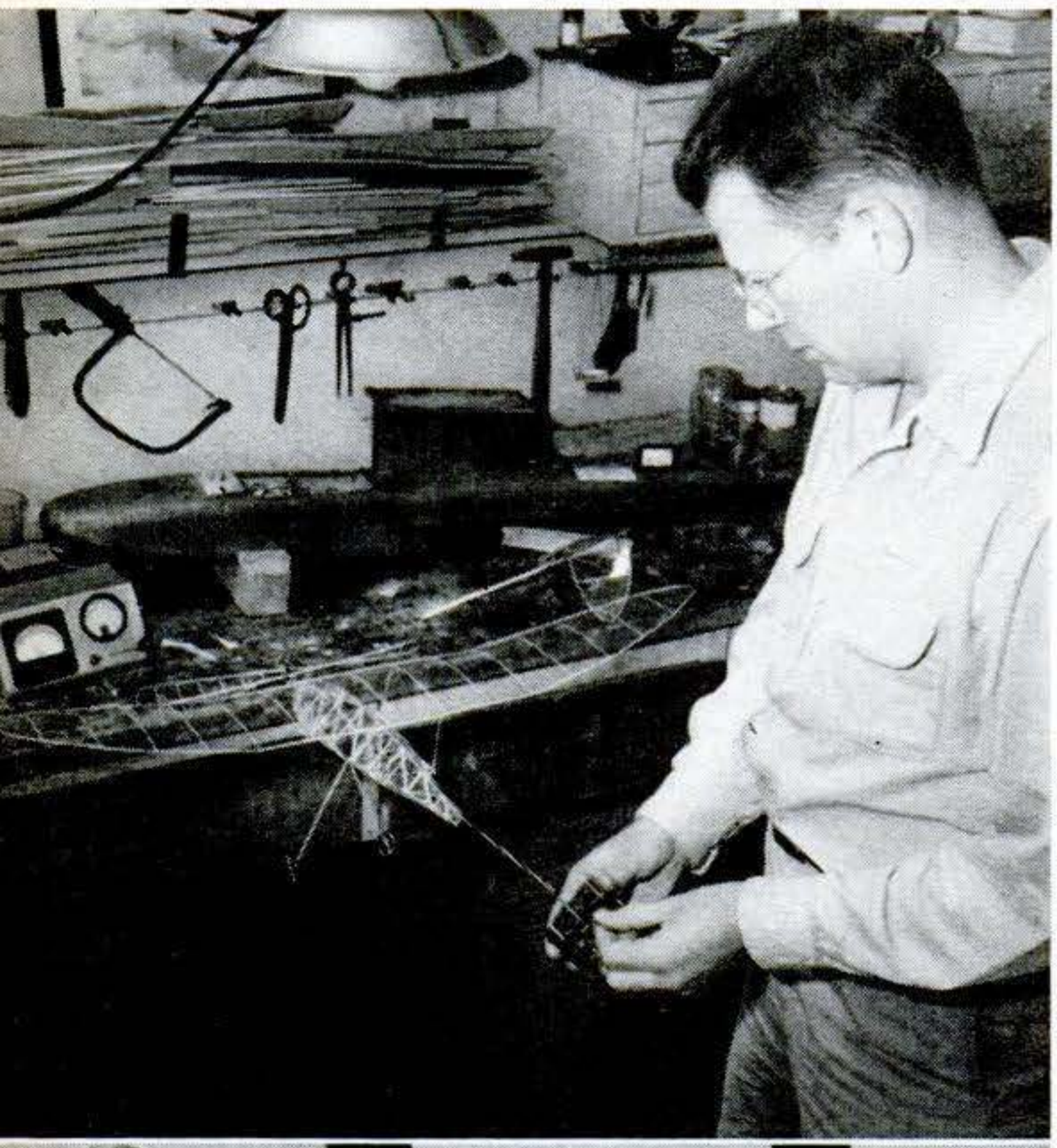
Winding the rubber-band power plant of this super-light plane could be tedious work. Struck does it the easy way, using the gear unit of an old clock. On the bench is a flying-boat model without its wings and a Struck-designed voltmeter with self-winding reels.



Cabin-type model flies over a desk designed and built by Struck. The plane, weighing 1/10 of an ounce, is flying at about three miles an hour, powered by a single-loop rubber band. It set a record some years ago by staying in the air for 16 minutes, five seconds.

paper off cigar boxes and cut out parts for locomotives, cars and a lot of other stuff. Most of it came out of POPULAR SCIENCE MONTHLY. When I got pretty good, I tried my hand at making unpowered model planes and gliders."

Then came the Lindbergh influence, and at the age of 12, Struck built his first rubber-band-powered pusher plane from plans that appeared in the July, 1928, issue of POPULAR SCIENCE MONTHLY. When that plane took off and flew, he was a confirmed model-plane builder and flier. He had a bureau workbench in one corner of his room, and he built six- and seven-foot models there.

Since that time, Struck figures he has built and flown at least 1,000 model planes, from tiny models weighing 1/10 of an ounce to the 54-ounce radio-controlled Seacat shown on page 167. He has won dozens of trophies at model-plane meets.

Hobby Led to Air Force Research

In 1940, his hobby led to a job with Ludington-Griswold, an aeronautical research group that had a small wind tunnel at Saybrook, Conn. It was a temporary job, building free-flight plane models and model wing sections to be tested in the tunnel.

He stayed nine years, doing a lot of secret work for the Army Air Forces.

The move to Connecticut was responsible for switching Struck's main interest from land models to seaplanes. Hamburg (population 265) is near the mouth of the Connecticut River on Long Island Sound, and there is more water around than open, level ground.

For newcomers to his hobby, Struck has some words of advice based on 26 years of experience with model planes.

"One trouble," he says, "is that beginners want to start too fancy. Simple, rubber-band-powered models are fun to build and fly. Your mistakes are inexpensive and will teach you to build them strong so that they can crash and still fly again. In that way you learn how they behave in the air and how to make adjustments. When you have mastered the building and flying of these types, you are ready to go on to gasoline-powered, radio-controlled jobs."

Struck, keeping up with the progress of aviation, has built and flown a swept-wing, rocket-powered plane, and is working on a ducted-fan jet-type model. **END**

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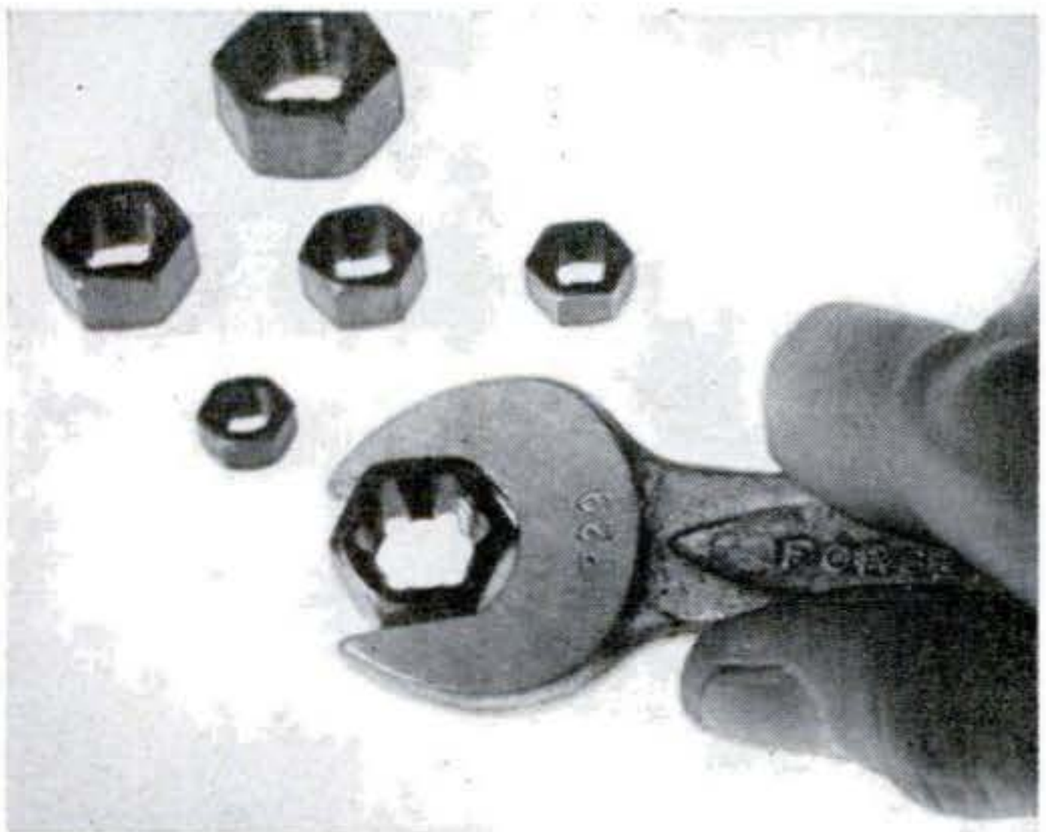
New Tools

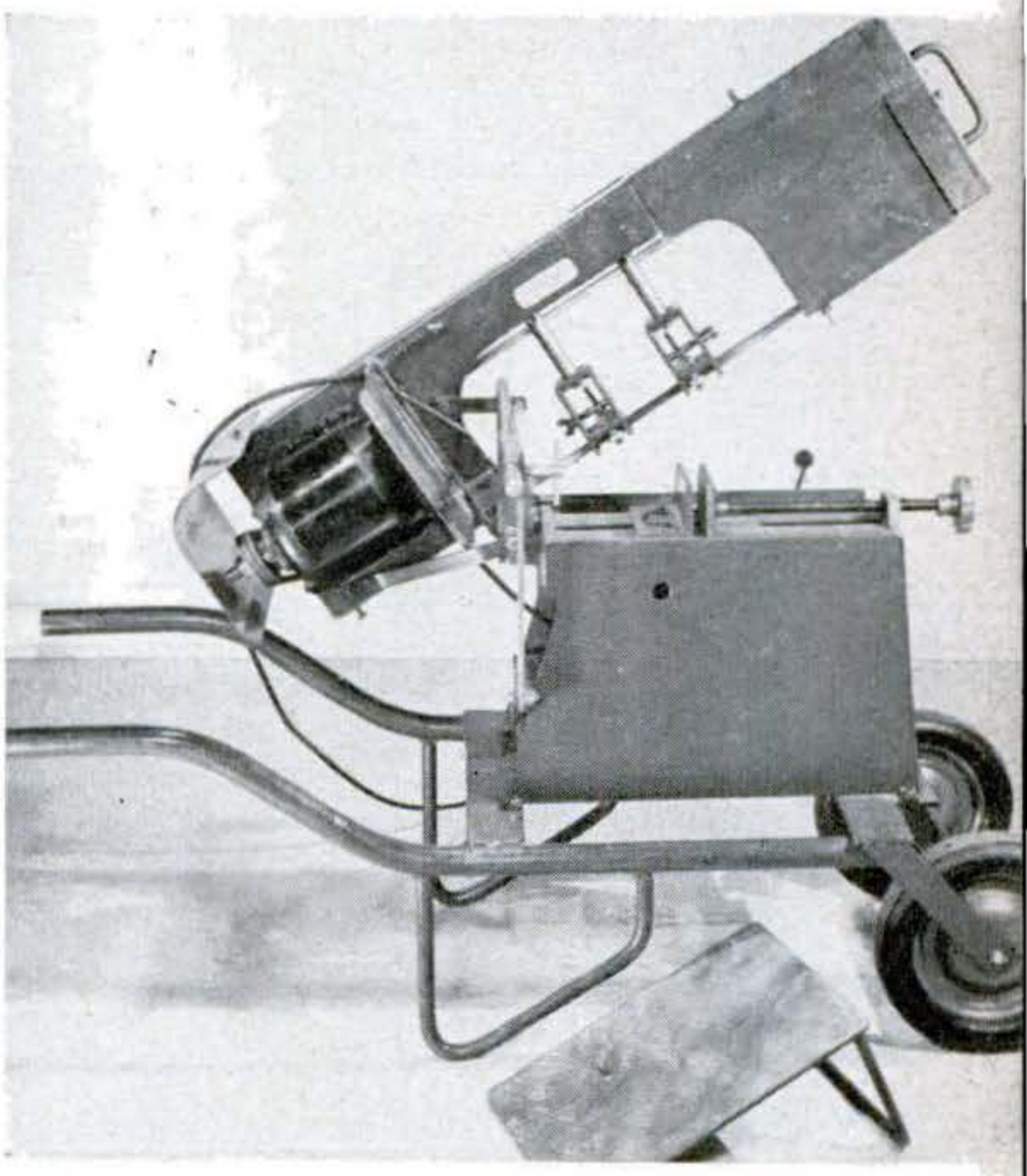
1. Hacksaw Has Two Blades. This double hacksaw has a coarse blade on one side and a fine one on the other so you can switch quickly from job to job without stopping to change blades. Because both blades are tightened against each other by a single adjustment, the saw is also said to provide greater tension than an ordinary one-sided hacksaw, making possible smoother cuts without blade twisting. Extra blades are stored in the hollow center tube.

2. Casters Fit Shop Tools. A touch of the toe moves these casters into place for easy rolling of heavy tools around a shop. Tilting the pedal the other way retracts the casters for stationary use. The new casters can be easily attached to any standard power-tool stand.



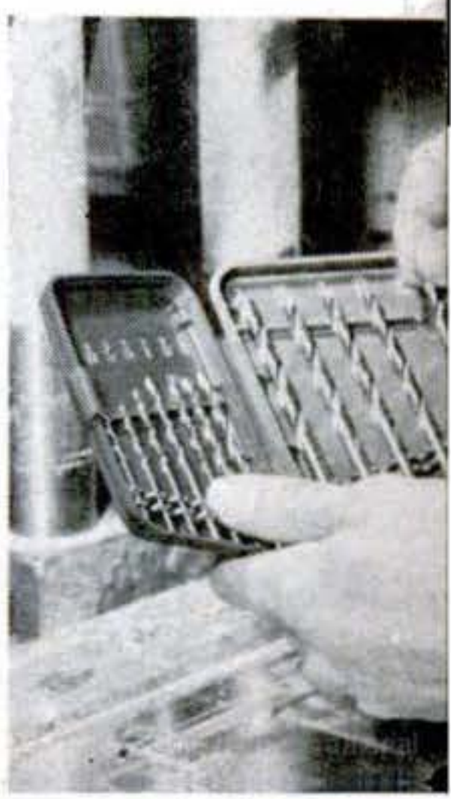
3. "Nuts" Restore Threads. These rethreading dies in the form of nuts make it easy to restore studs and bolts with any box or open-end wrench. The dies do not cut new threads, but simply restore damaged or rusted ones, so the original nut can be replaced without causing a sloppy fit. They come in eight sizes from ¼″ to ¾″ and in both USS and SAE threads.

Further information on the tools shown on this page can be obtained from: 1. Dreier Brothers, Inc., 5642 Lake Park Ave., Chicago 37, Ill.; 2. Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Pa.; 3. Jaw Mfg. Co., 39-41 Mulberry St., Reading, Pa.; 4. McCarty Machinery Sales, Bayfield, Wis.; 5. Rinck-McIlwaine, Inc., 16 Hudson St., New York 13, N.Y.



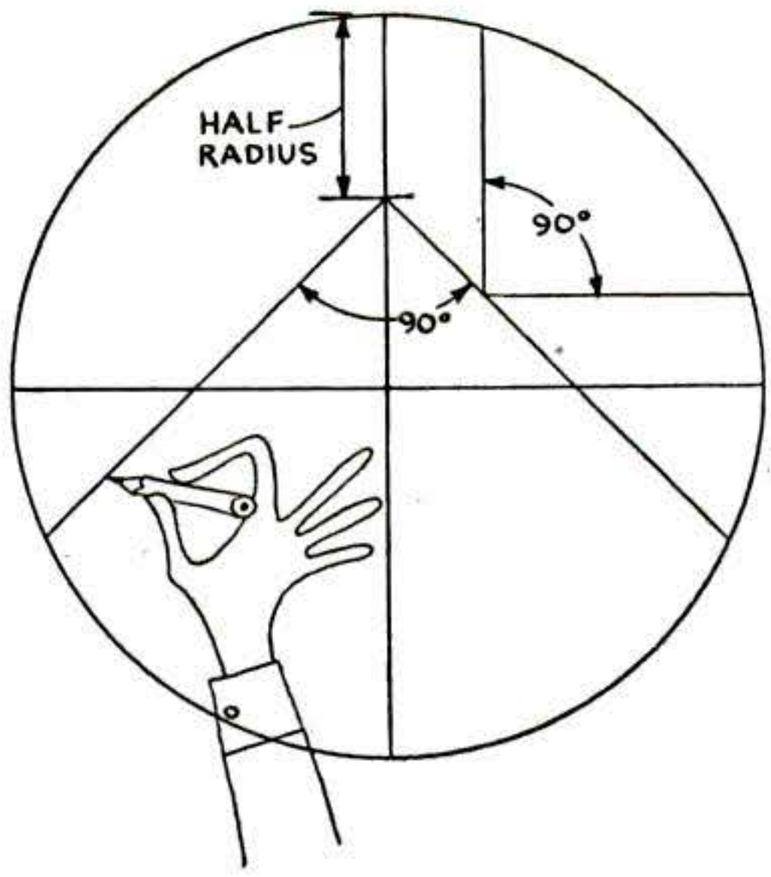
4. Bandsaw Rolls to Work. Mounted on a wheeled cart, this metal-cutting bandsaw can be easily rolled like a wheelbarrow from one construction job to another. The tilting carriage moves both up and down and sideways, and adjustable blade guides permit angle cuts up to 45°. It has a ¼-horse motor and a throat capacity of 9″.

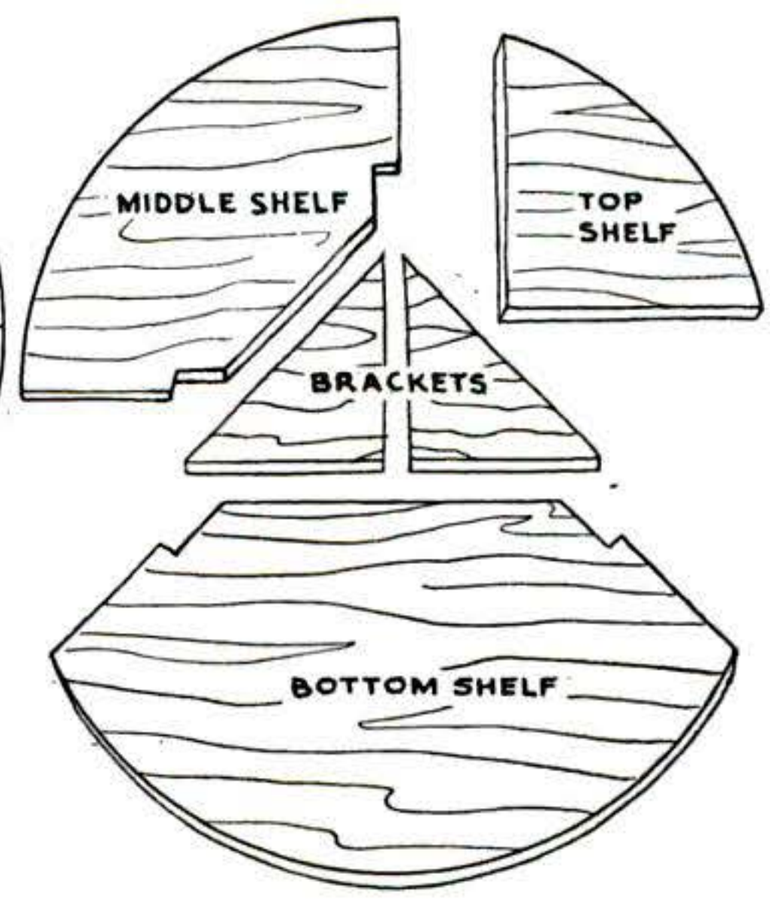
5. Plastic Drill Case Won't Break. You can drop this drill set on your workshop floor or bang it around in a toolbox without danger of breaking the tough, flexible-plastic case. It holds 13 high-speed drills in sizes from 1/16″ to ¼″.

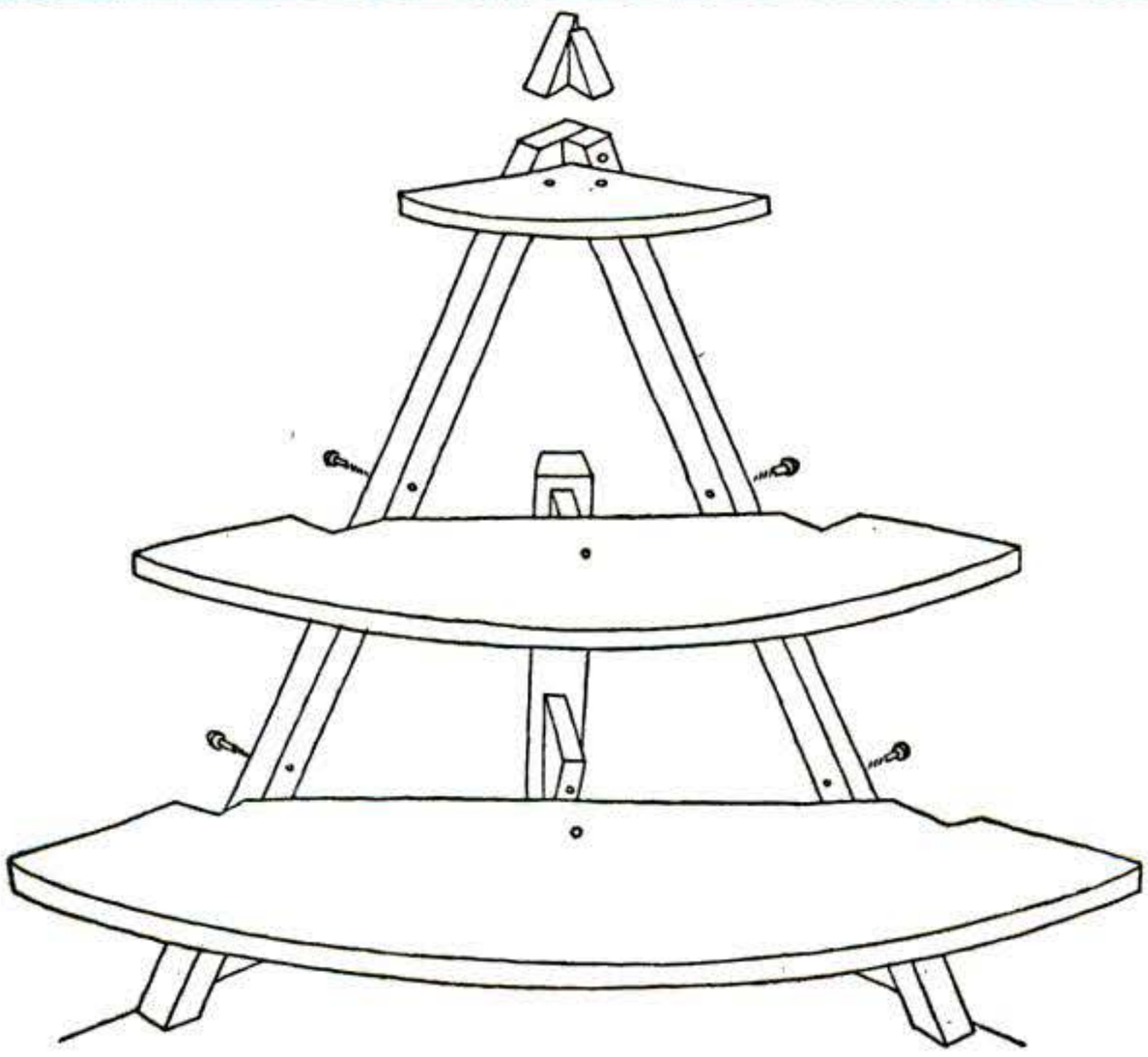


By Roy Doty and Warrant Pryor

Wordless Workshop







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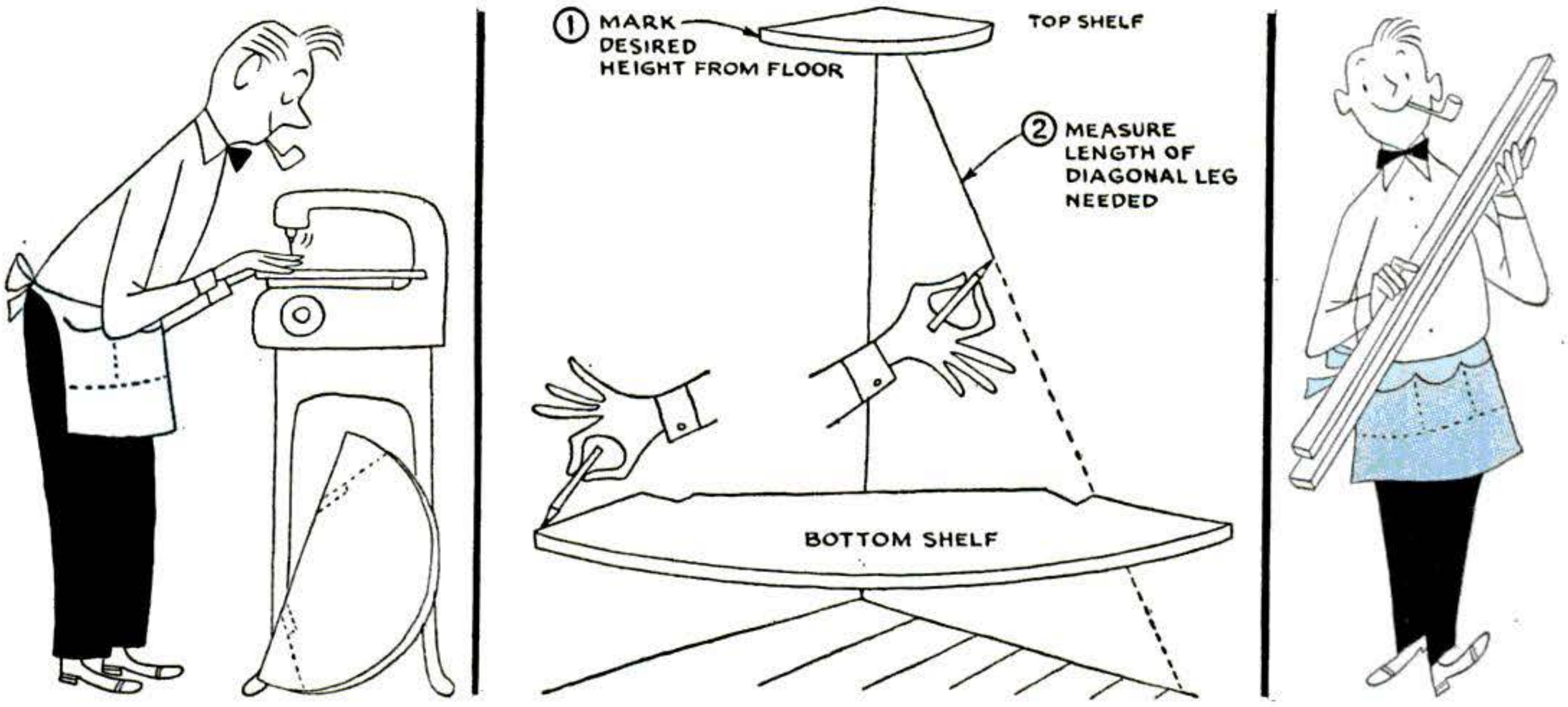

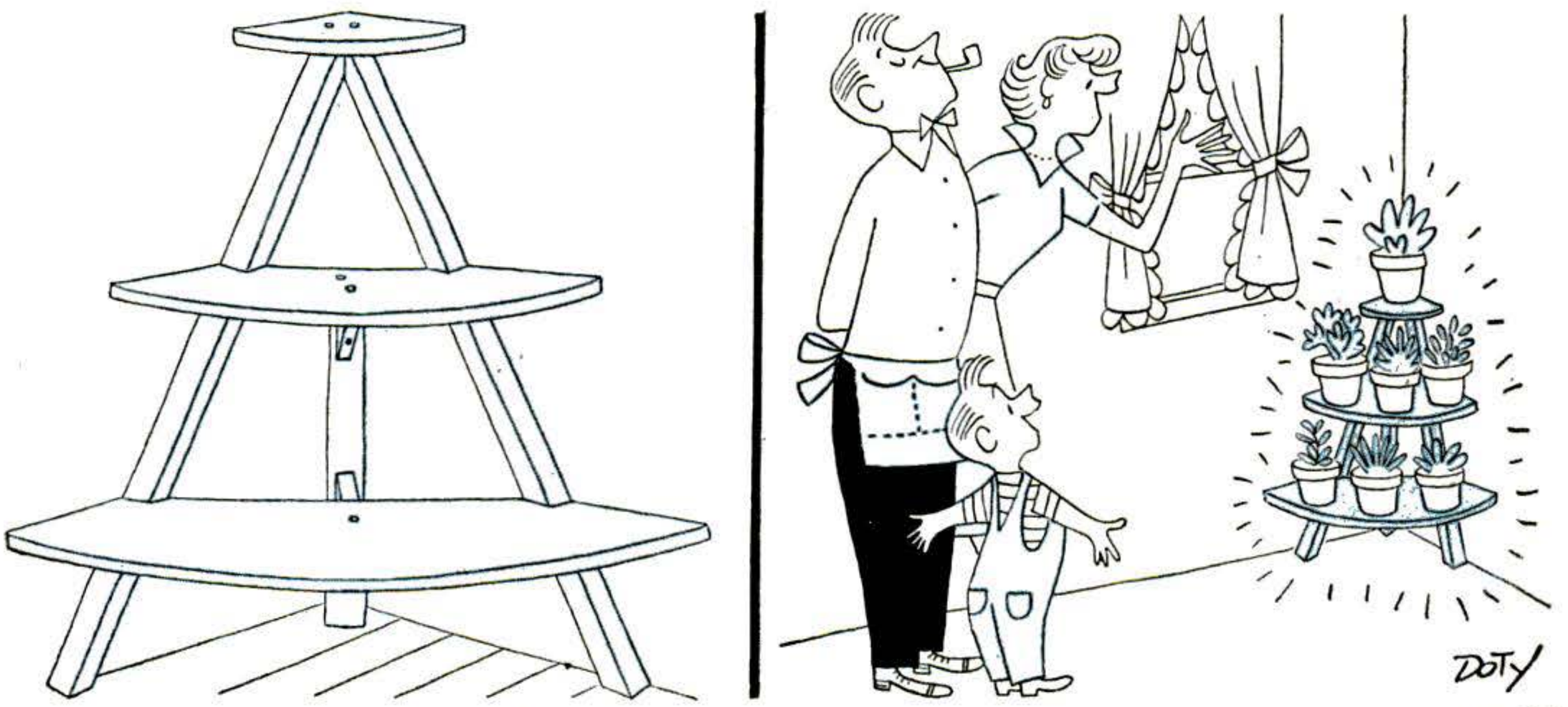

Next Month: A tripod brace to safeguard your camera.

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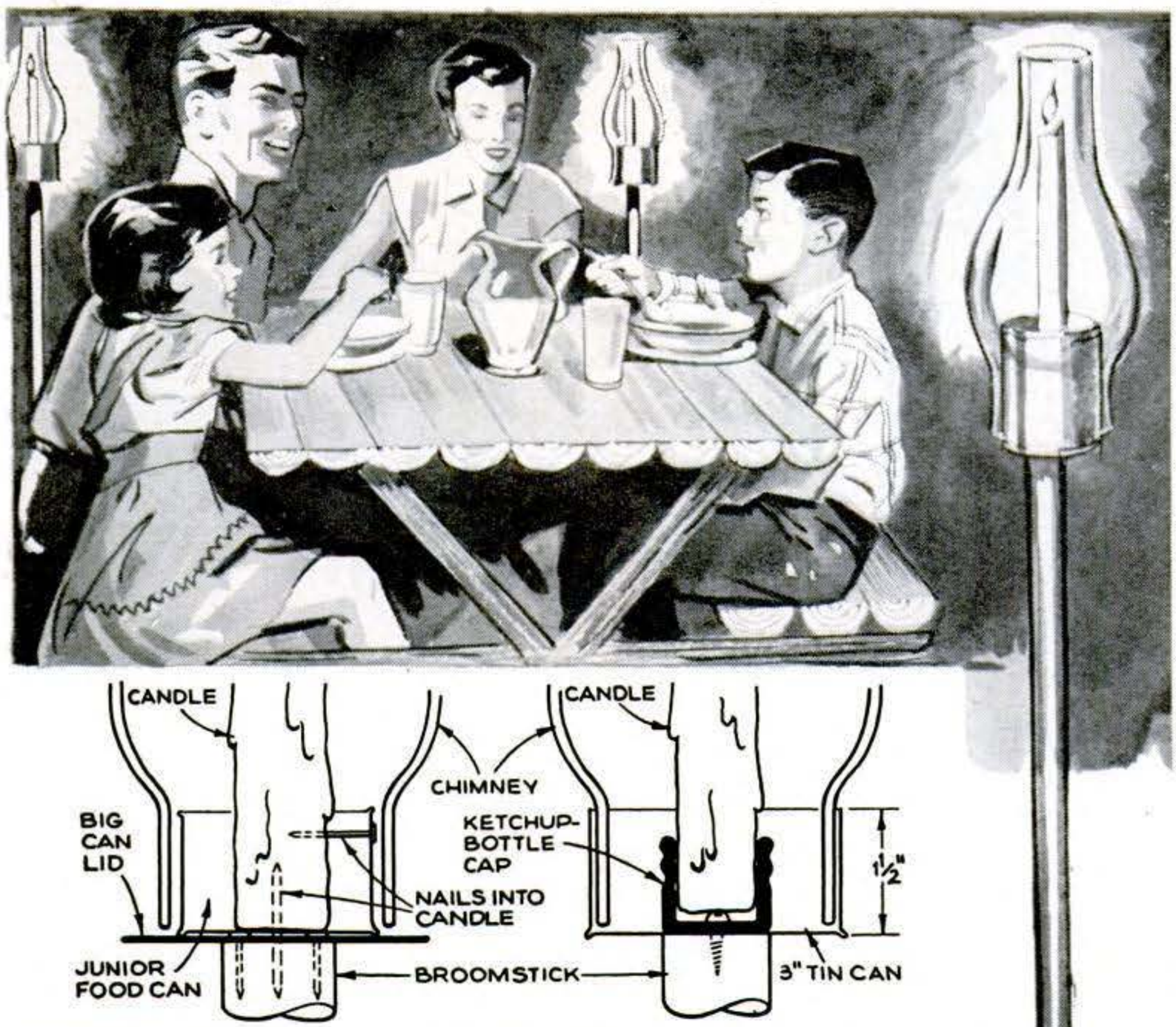
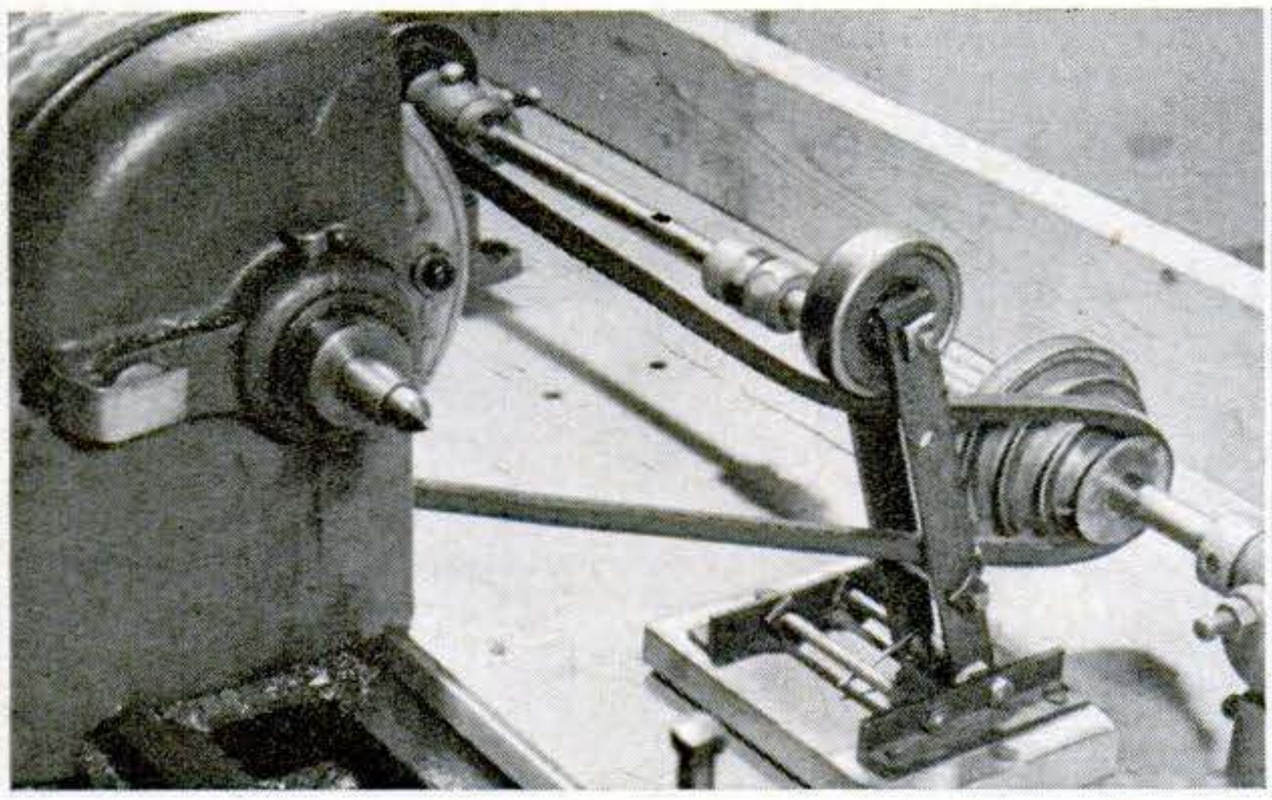
How to Enjoy Outdoor Evenings This Summer by Candlelight

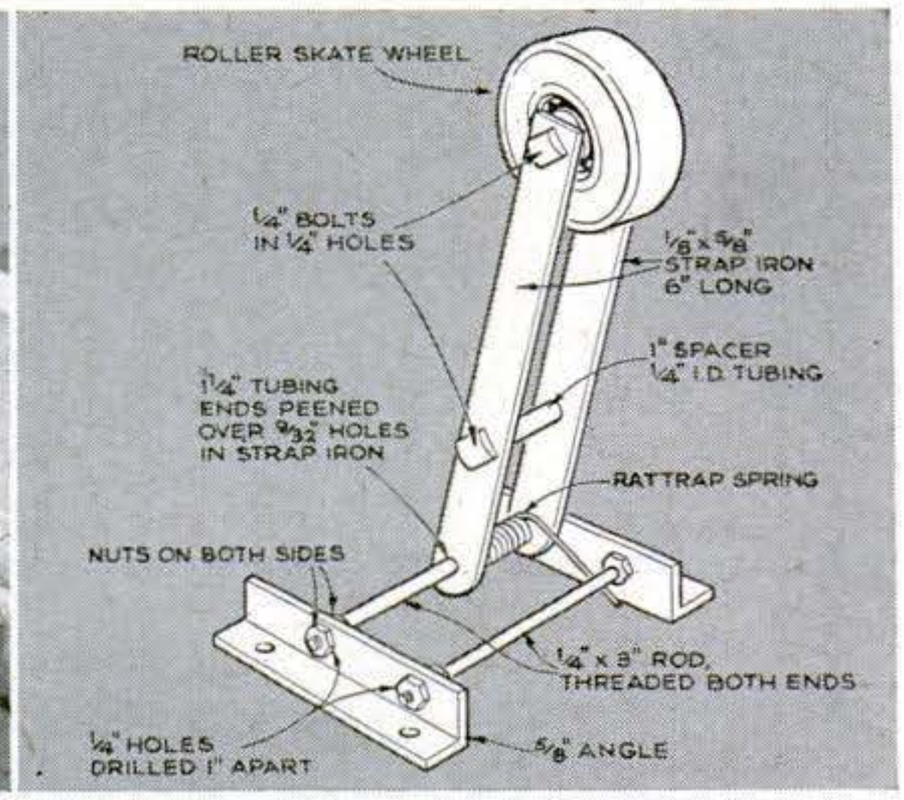


OUTDOOR LIGHTS can be made with glass lamp chimneys in two ways. No wax will drop on the lawn, and candles stay lit in wind. Sharpen posts to push into the ground.

LENGTHEN the evenings for back-yard get-togethers with candlelight. Lamp chimneys, costing only pennies each, can be mounted on broomstick posts to make yard lights.

One way is to nail a "junior-food" can on with a bigger can lid between. This forms a ledge for the chimney, which fits around the can. Two nails, one through the can side, hold the candle. A second method is to cut a vegetable can to 1½" in height and screw it to the post with a bottle cap inside. The chimney fits into the can, and the cap holds the candle. Thick candles are most economical.





Skate-Wheel Idler Takes Up the Slack in a Loose V Belt

CHANGING the speed of a V belt on fixed step pulleys is made easy with this spring-loaded idler that takes up slack of a loose-fitting belt when the machine is running.

Mount the roller-skate wheel between two 6" lengths of ⅛"-by-⅝" strap iron and squeeze the middle of the straps against a 1" length of brass tubing to space them evenly apart. Slip a spring from a strong rattrap over a 1¼" length of ¼"-inside-diameter tubing and insert the tubing ends in 9/32" holes drilled in the bottom of the iron straps. Peen the ends of the tubing over the straps to hold it in place. Assemble the idler on a base of two angle irons with 3" lengths of ¼" rod threaded at both ends. Lock the rods on the angle with two nuts, tightened against each other, on each threaded end of the rods.

Mount the idler on the bench or machine so that the straps lean 45° in the direction of belt travel when it is taking up the slack. Raising the arms to the top of their swing frees the belt for changing steps. The arms slide on pivot rod and move sideways with the belt.—*J. M. Finn, Pittstown, N. J.*

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July 4th Fun Can Be Safe

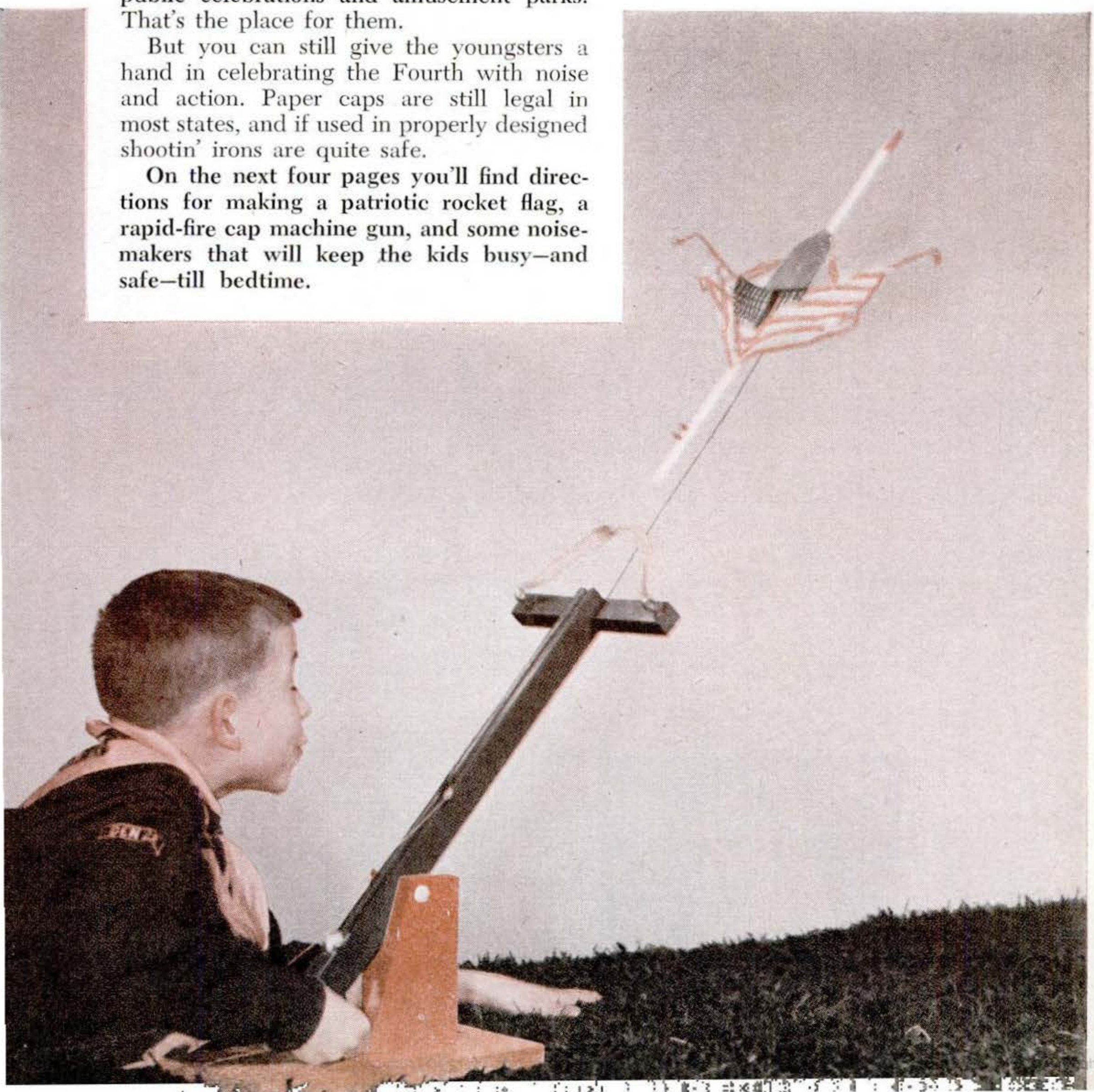
Here are seven quickly made toys that will give youngsters a happy celebration this year.

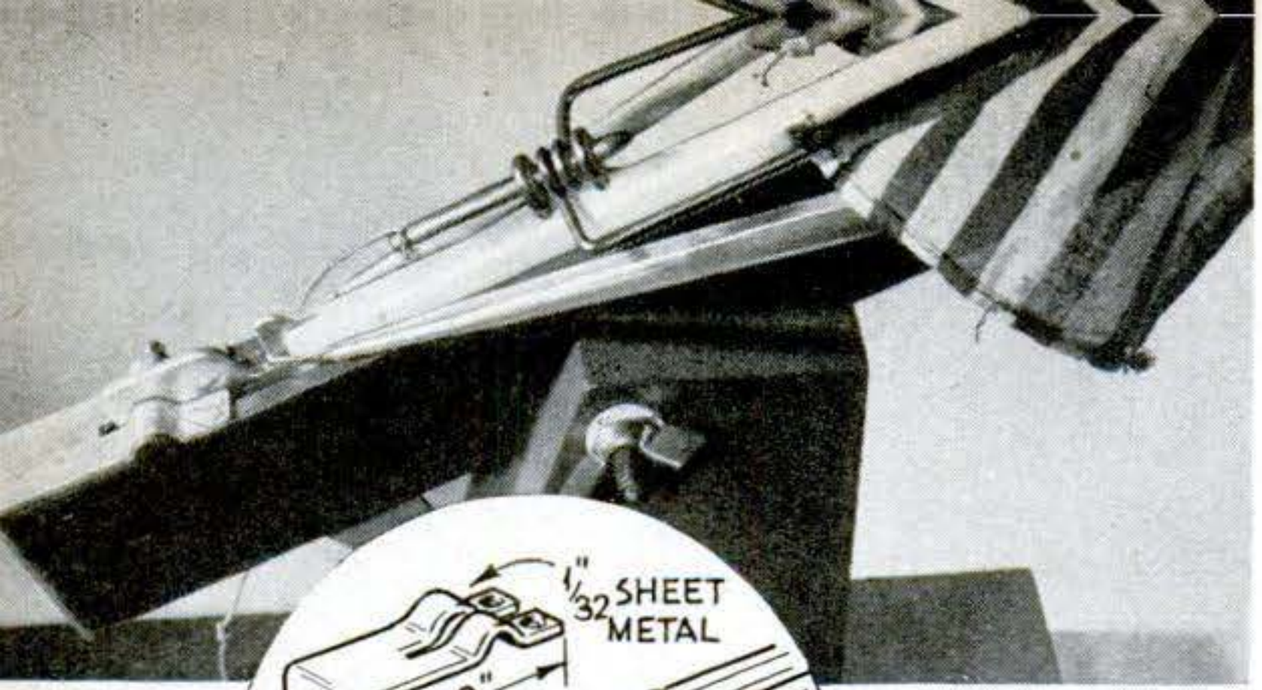
REMEMBER when the Fourth was a day of cannon crackers, skyrockets, pinwheels and roman candles? Fun, weren't they? But what marred those good old days was the salute that went off in a child's hand, the fizzler that let go when somebody looked at the fuse, the roman candle that backfired, the skyrocket that landed on a shingle roof.

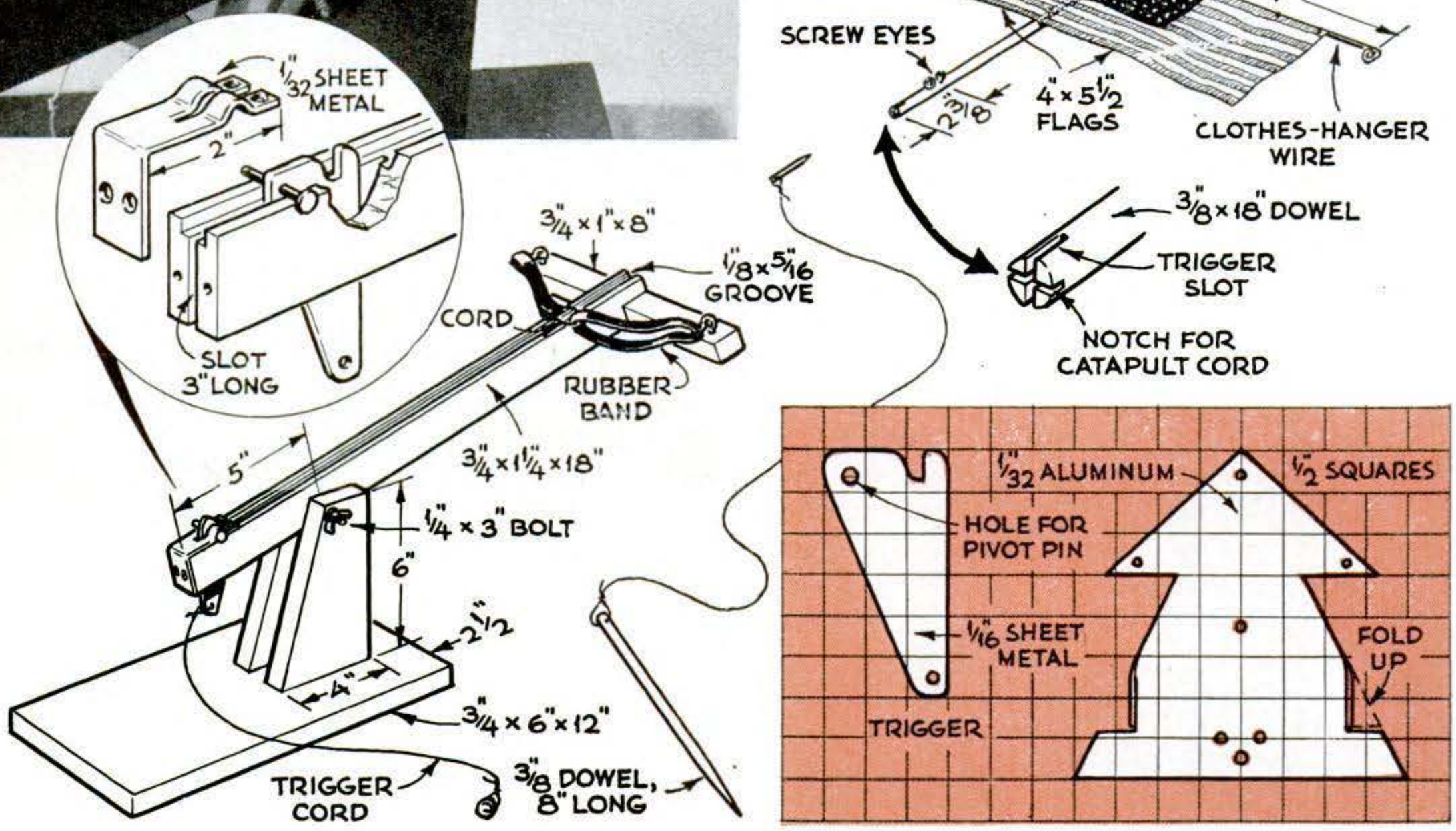
Today, 27 states and many cities limit the use of fireworks. Deaths and injuries from July Fourth mishaps are down. You can see beautiful fireworks displays at public celebrations and amusement parks. That's the place for them.

But you can still give the youngsters a hand in celebrating the Fourth with noise and action. Paper caps are still legal in most states, and if used in properly designed shootin' irons are quite safe.

On the next four pages you'll find directions for making a patriotic rocket flag, a rapid-fire cap machine gun, and some noisemakers that will keep the kids busy—and safe—till bedtime.



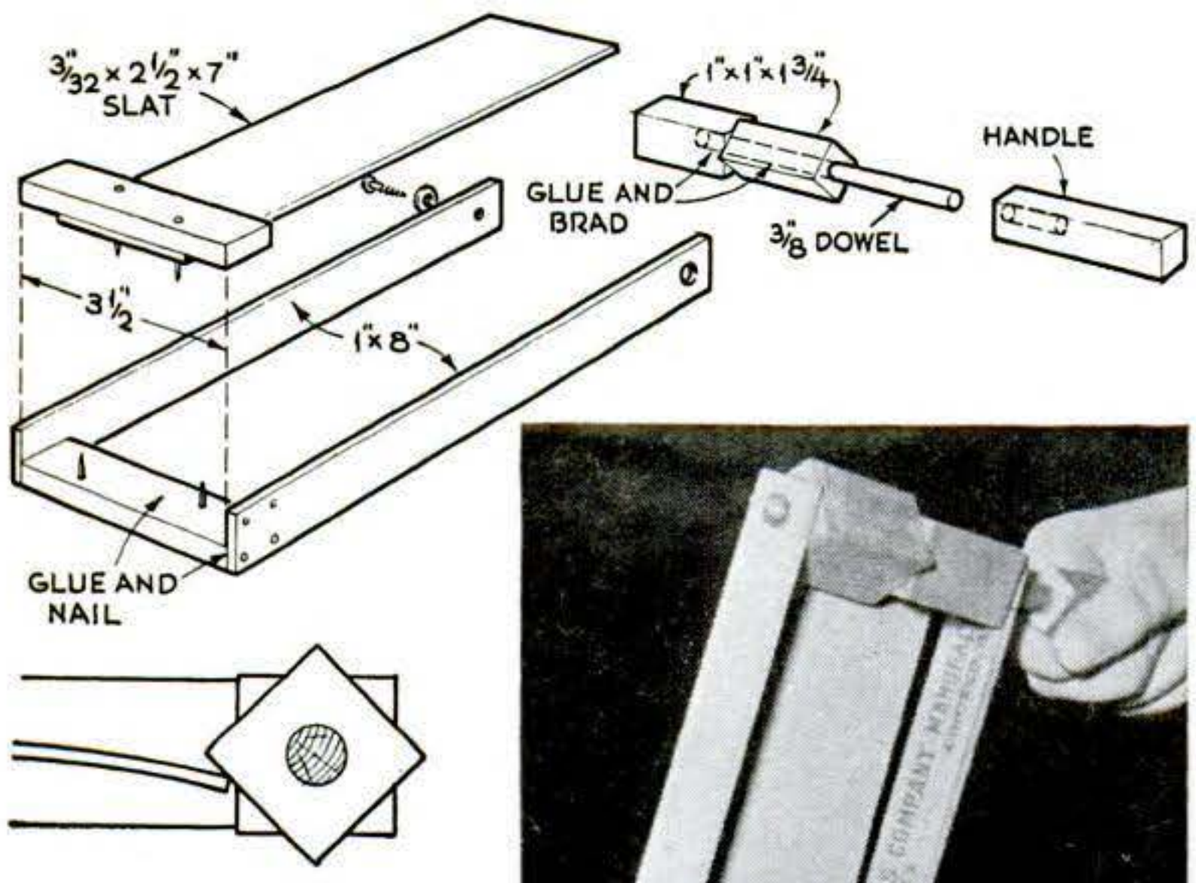


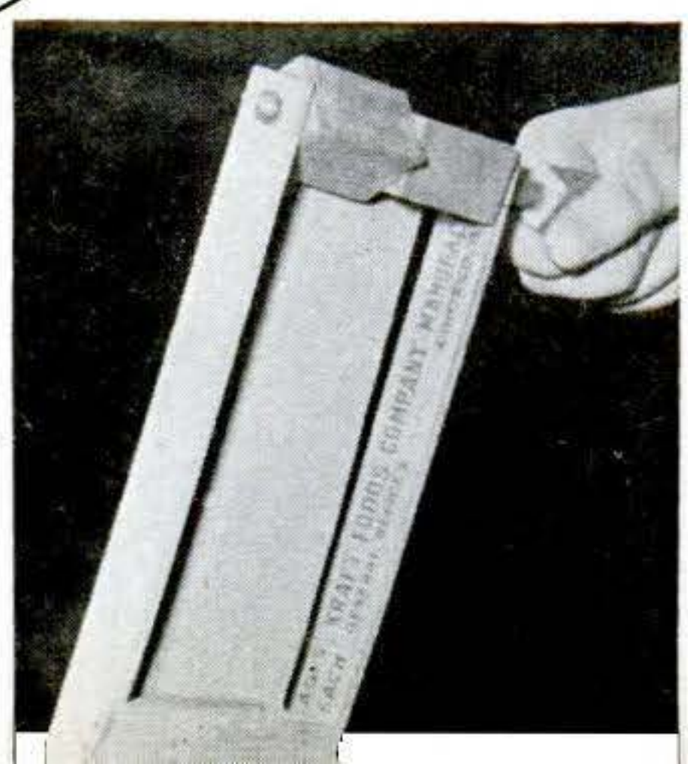


ROCKET FLAG

HERE'S real action with a burst of red, white and blue at the peak. The launching rack, a grooved piece, is mounted between the uprights by a bolt and wing nut. Two heavy rubber bands through screw eyes in the crosspiece are joined by a bit of strong fishing line.

Two coat-hanger arms pivot on small bolts fastened with nuts to the arrow-shaped plate screwed to the rocket. Rubber bands pull both arms outward. In setting up the rocket for firing, the flag arms are folded back with their looped ends between the two screw eyes on the dowel, and are held in by a nail or small pin, which is tied to a stake or to the front of the base. The trigger slips up into the long notch at the end of the rocket, and the cord joining the catapult elastics is slipped over the shallow horizontal neck and when tight it will lie within the trigger notch. Pulling the lanyard tied to the bottom of the trigger fires the rocket. A sponge-rubber ball should be securely cemented to the front.





SWING RATTLE

THIS familiar slat-and-sprocket noisemaker is made largely from a cream-cheese box. The box sides serve as the sidepieces in the toy, and the ends are nailed together with the slat, cut from the bottom of the cheese box, between them.

The sprocket is made from 1″ square hardwood, two pieces being glued on a piece of dowel at a displacement of 45°. The dowel is slipped through a hole in one side, and the other end of the sprocket is retained with a washer and wood screw. Since tooth depth is limited, the slat should enter as far as possible.

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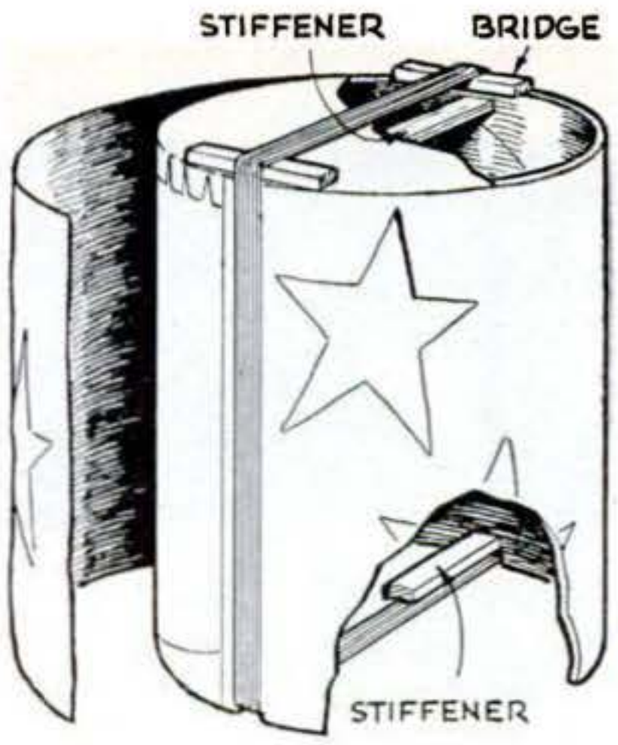


BOX O' CRACKERS

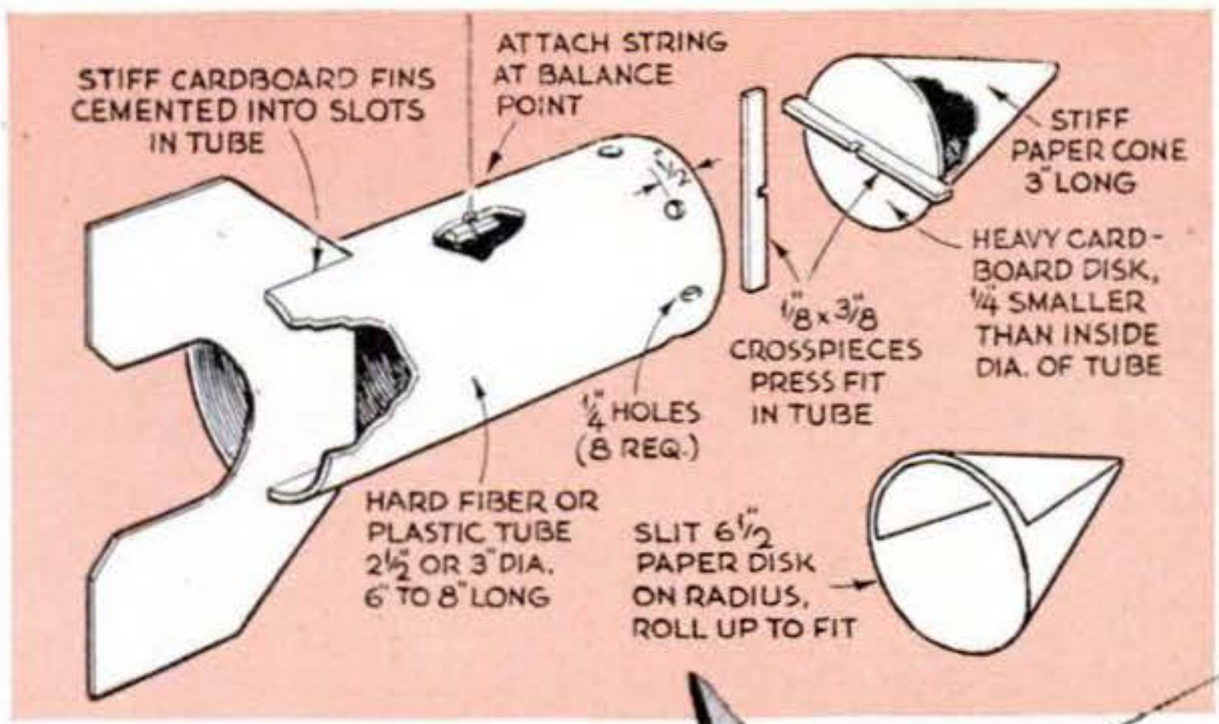
THE brittle chatter of "lady crackers" is punctuated in this noisemaker with a cannon-cracker bang. Cut an 8″ length of 5″ or 6″ shipping tube and cement on a head of tough manila paper. Glue in wooden stiffeners at bottom and top. Moisten paper head so it will tighten on drying. Stretch half a dozen thin rubber bands around tube, and one heavy one. Pluck thin bands for the rattle of crackers, the big one for the bang.

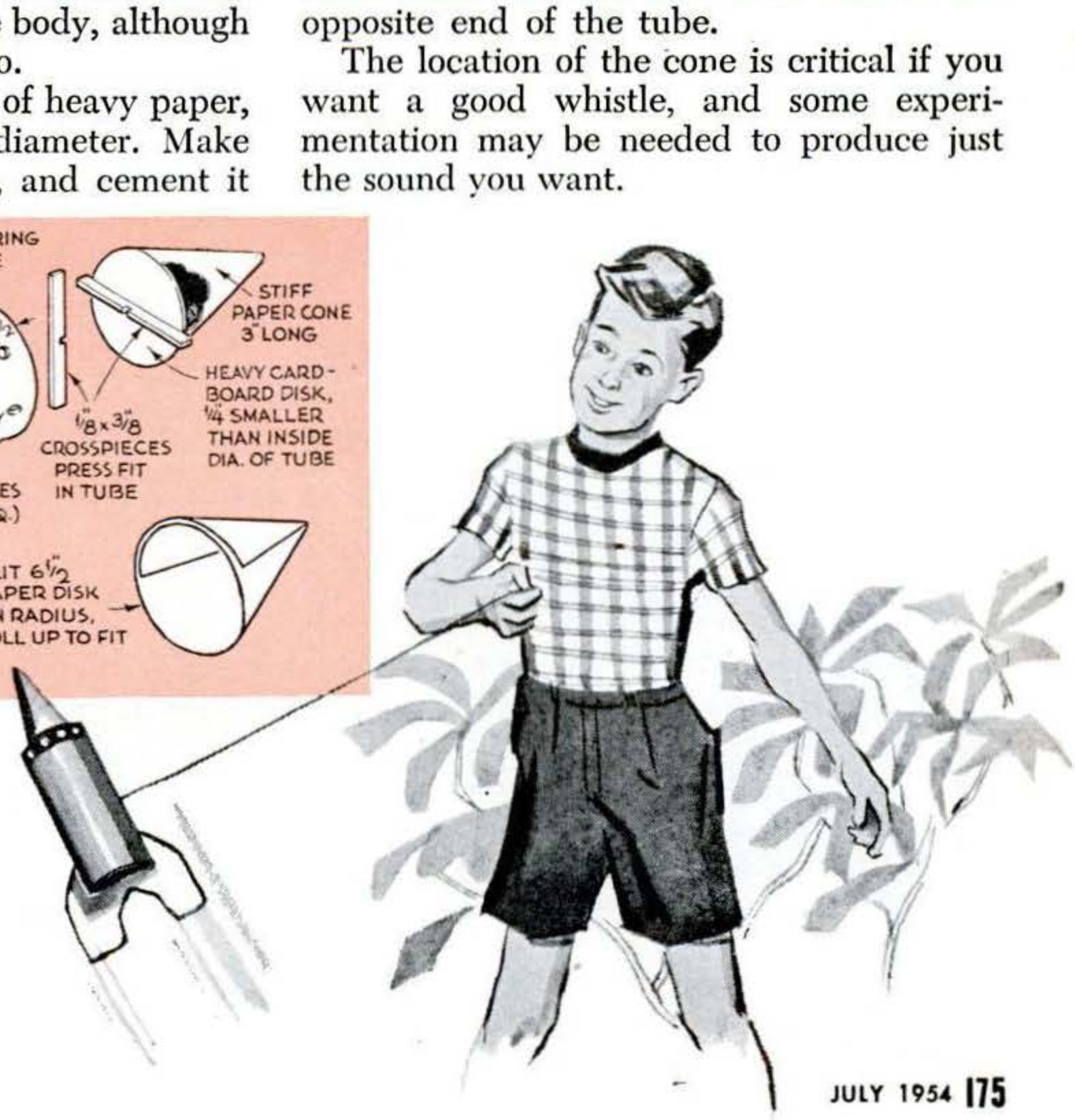
RAMJET WHISTLE

WHIRL this whistle around at the end of a 5′ string and it will howl like a banshee. A fiber or plastic tube is best for the body, although a stout mailing tube might do.

Roll the cone from a disk of heavy paper, overlapped to the proper diameter. Make it ¼″ smaller than the tube, and cement it to a cardboard disk of the same diameter. Cross-lap two sticks as shown, letting them project to form a tight fit in the end of the tube. Slide the tail into slots cut in the opposite end of the tube.

The location of the cone is critical if you want a good whistle, and some experimentation may be needed to produce just the sound you want.





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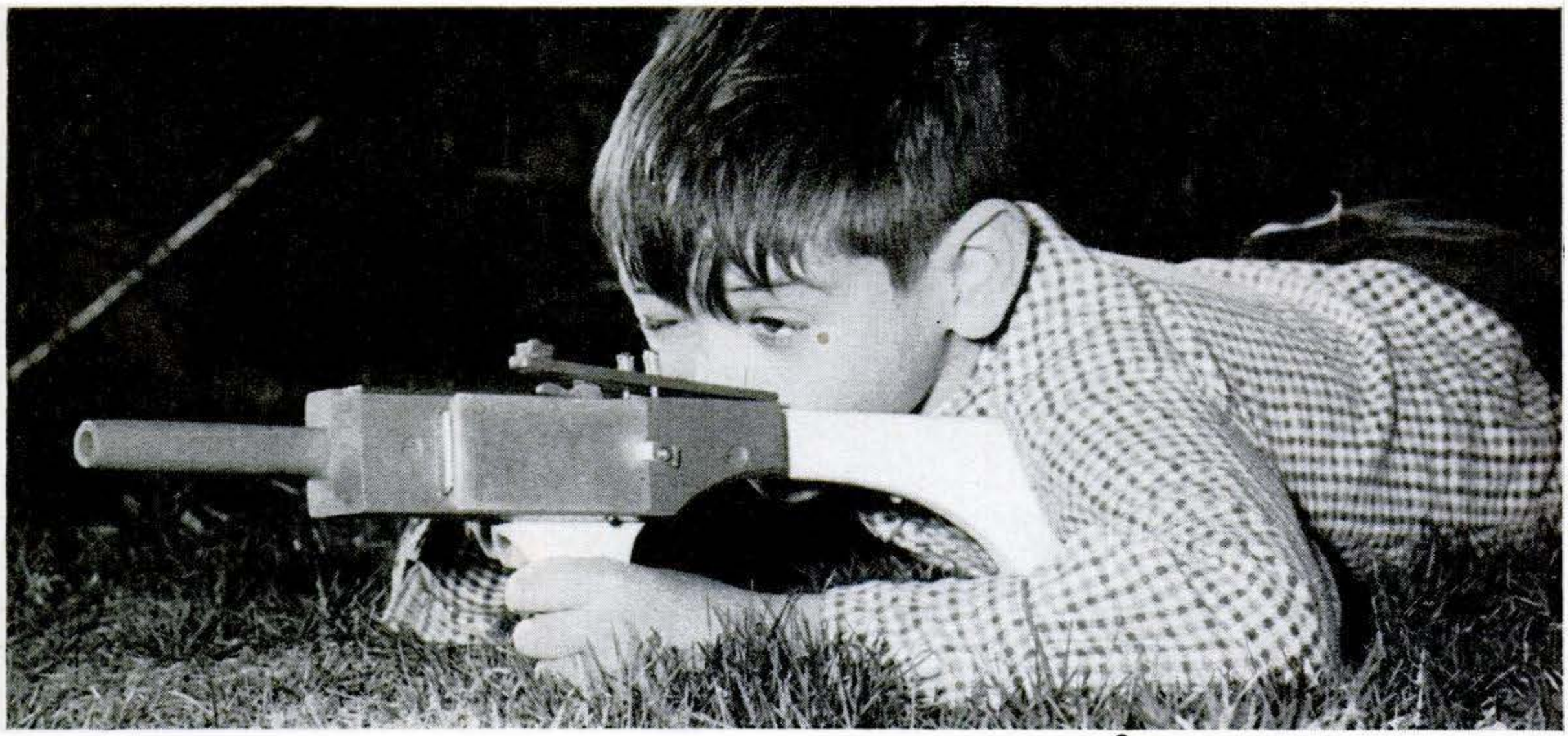

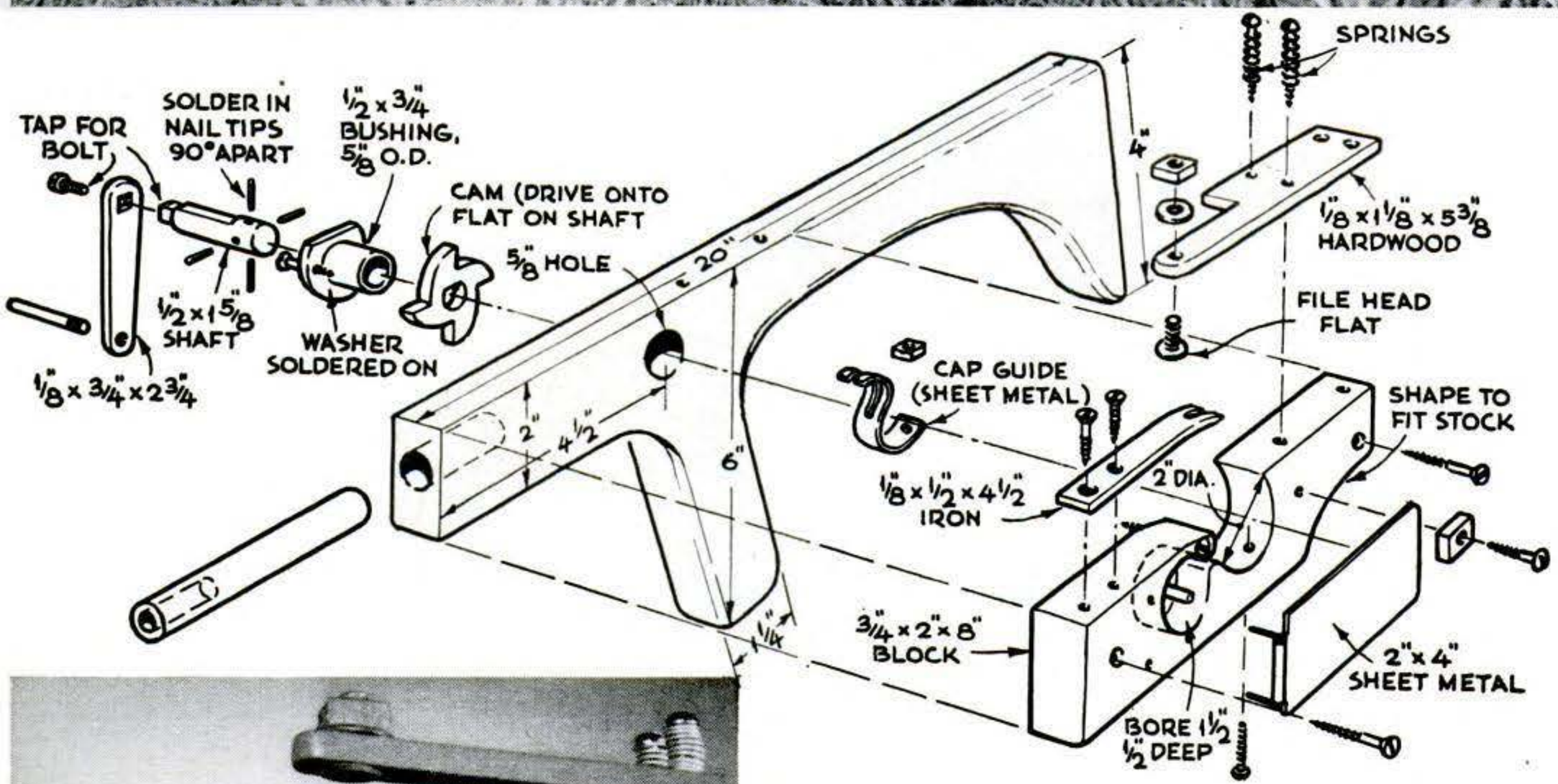

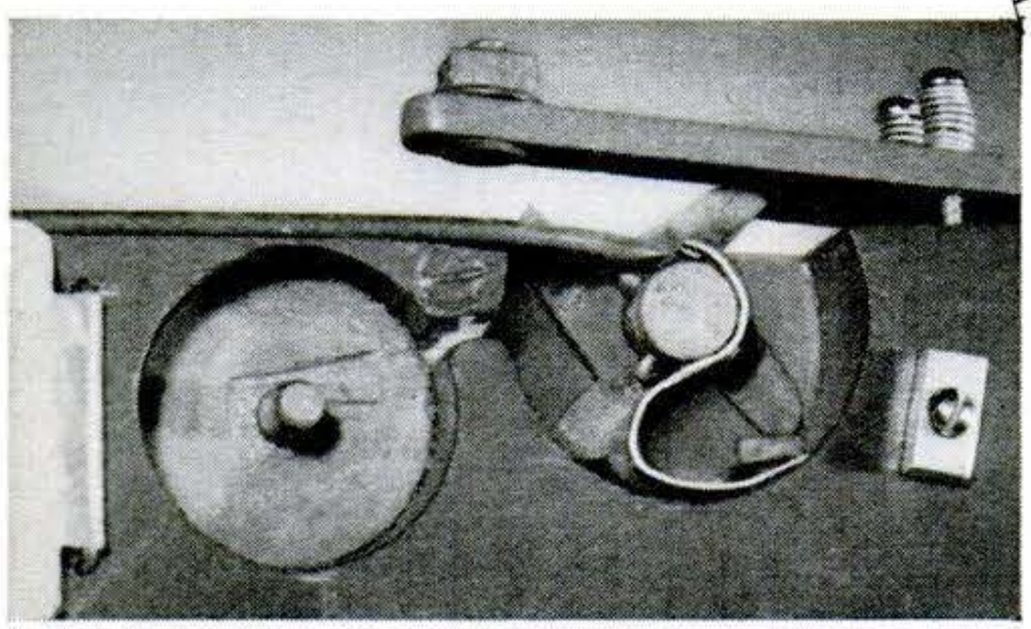

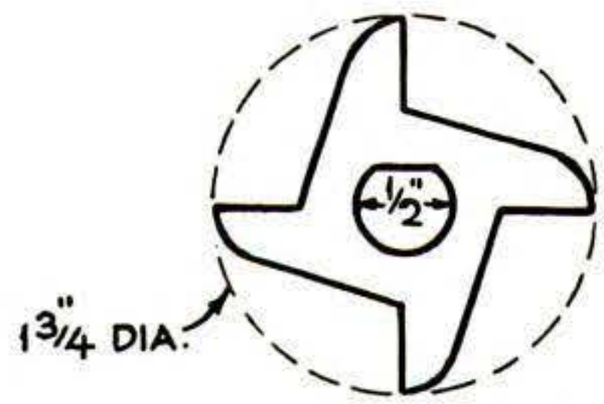

CAP-FIRING MACHINE GUN

THIS fast-shooting piece uses rolls of *perforated* caps. The holes, spaced one cap apart, run over pins in the camshaft and so are positively advanced. Make sure of your cap supply first, for not all dealers stock them.

Saw the frame to shape and drill a 5/8" hole for the bushing in which the camshaft turns. Solder a large washer to the bushing so that it can be screwed to the right-hand side of the gun. Shape the breechblock and glue and screw it in place. The camshaft is filed from 1/2" rod or a 1/2" bolt. File a flat for the cam hole, file the cam to a tight fit, and drive it on. Drill crosswise holes through the shaft and solder in four nail ends projecting 3/32".

The cam lifts a hammer made of 1/8" hardwood and loaded by two springs. It is attached by two screws left loose. A bolt at the end strikes a steel firing plate.

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THE RAUCOUS CAN

It's simple, but this can makes a nerve-shattering racket, surely enough to satisfy any youngster.

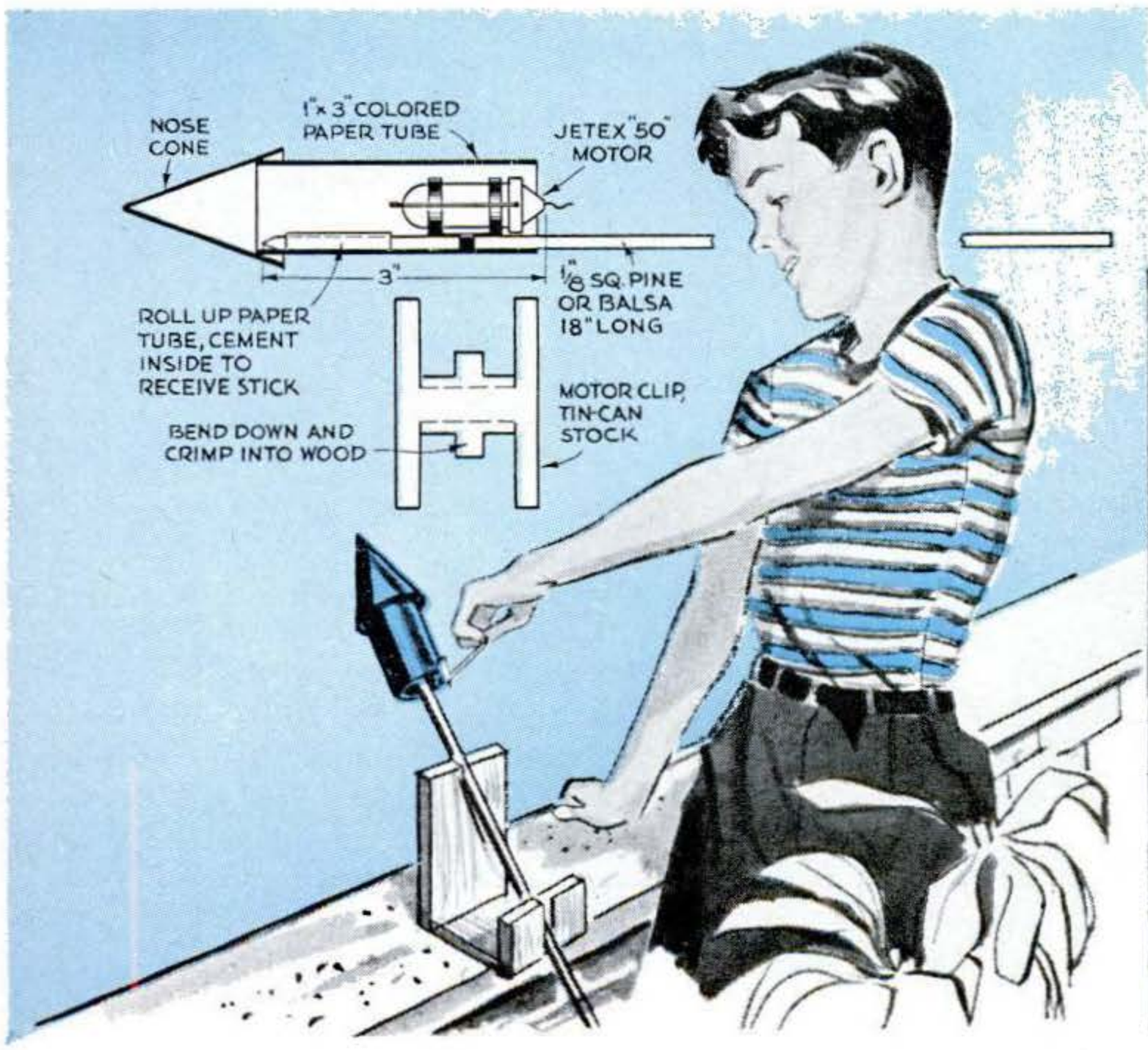
Cut the top out of a No. 2 tin can. Punch a small hole in the center of the bottom. Tie a knot at the end of a 4′ length of string and pull the other end through the hole. Rub rosin all along the string.

Once the string is well coated, simply pulling the fingers along the string brings forth the decibels. The day's efforts may prove rough on young fingers, which can be protected by pads of adhesive tape.

DAYLIGHT SKYROCKET

This real fireworks piece will be safe in the hands of any youngster who can be trusted with matches, and who can handle the cartridge and fuse needed.

It makes use of a harmless model-airplane jet motor, which can be refueled and shot again and again. Since it trails no sparks, the rocket affords no fire hazard, but it should be made in bright colors and fired in daylight. Keep the weight down and trim the stick so that it balances on a line with the orifice of the jet engine. END



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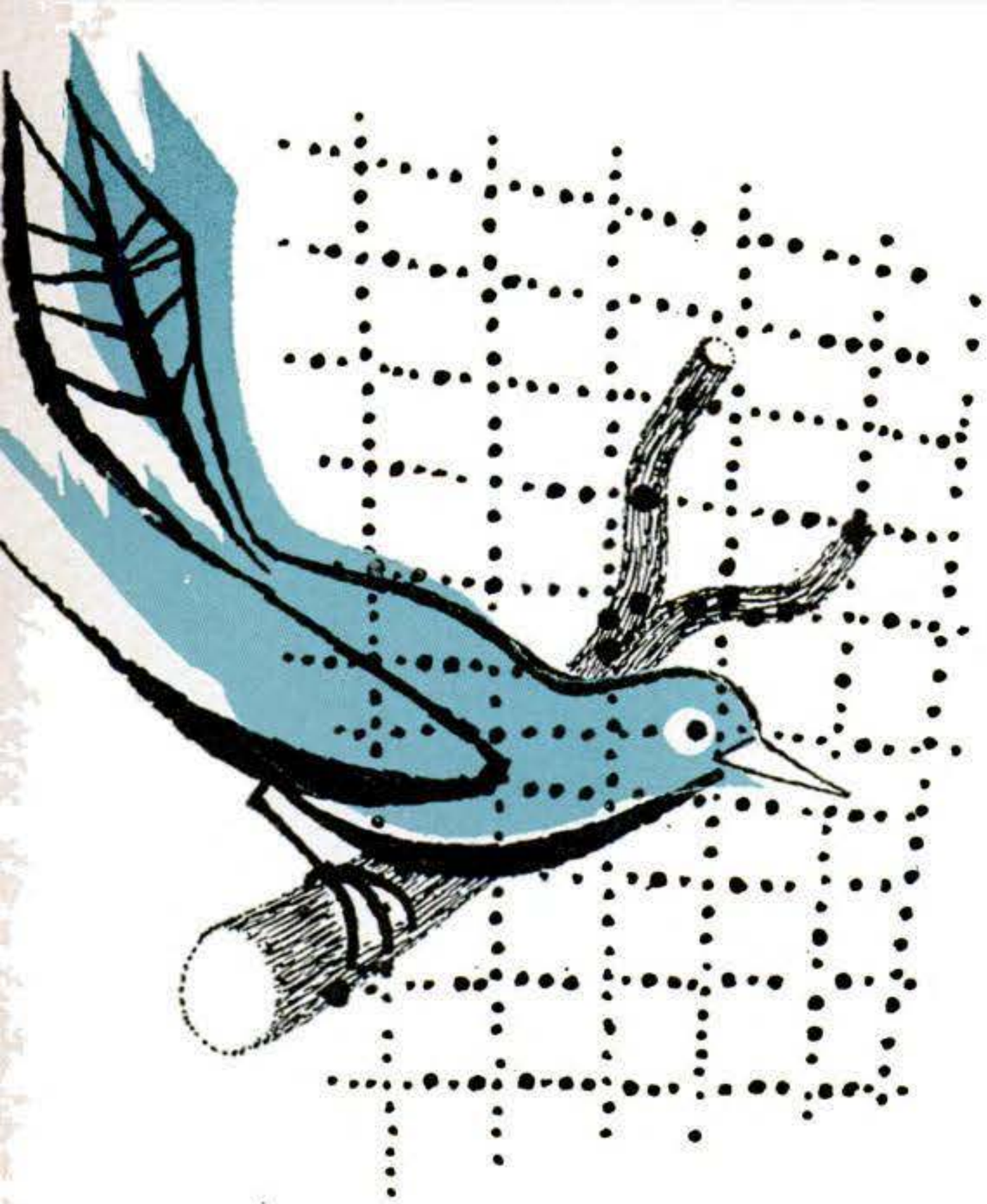


An Aviary Can

Here are four types to choose from. Netting and wood scraps are what you need to build 'em.

By Jerry Parker

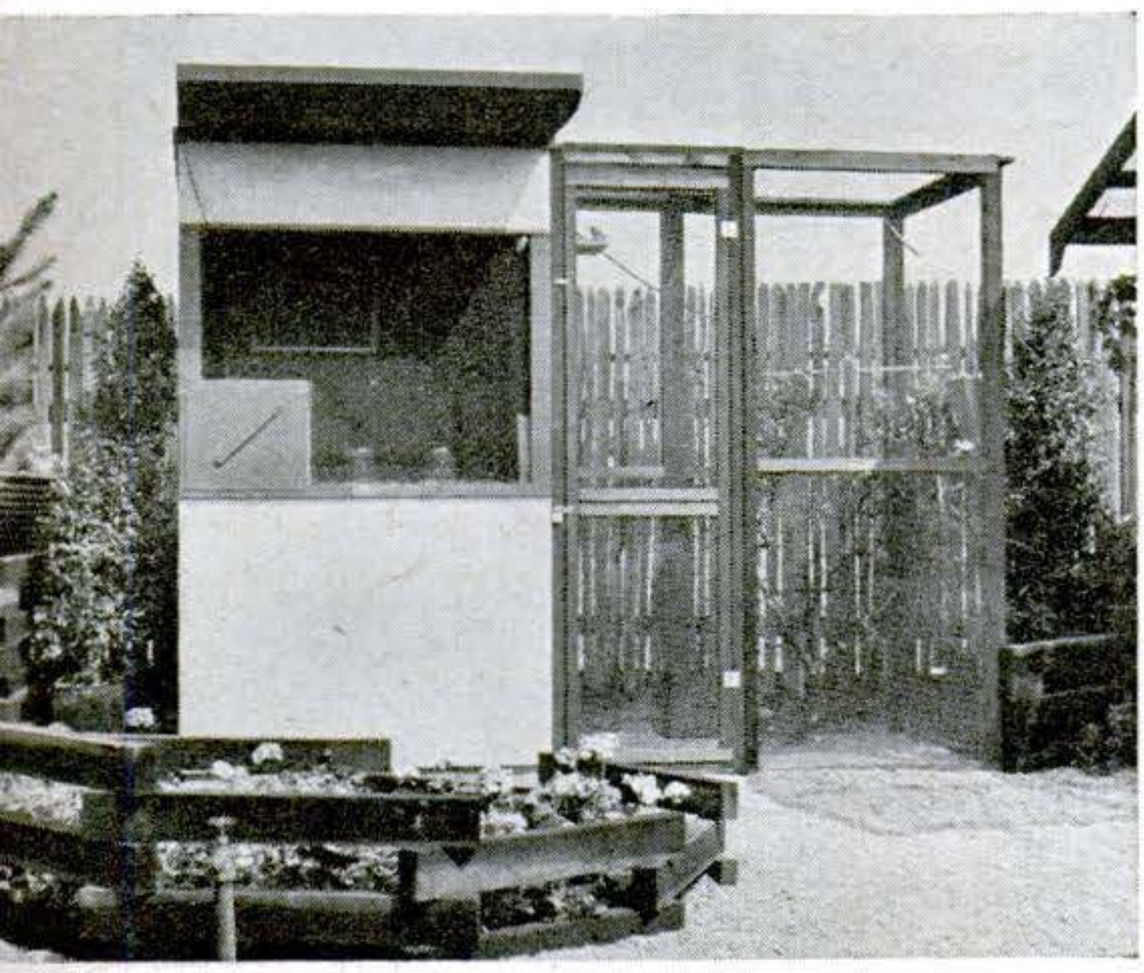
IF YOU raise birds—canaries, parakeets or what have you—why not move them outdoors for the summer? You can do it by building an aviary, a large outdoor cage that gives them space to spread their wings. Carefully placed and built, the aviary will be the show spot of your yard or garden.

The photographs on this and the facing page show four aviaries designed for use in California, where the birds usually can remain outdoors the year round. You may not want to build an aviary this elaborate, but the examples suggest what it is possible to do.

Any aviary must safeguard the birds from predatory rodents and animals. The experts suggest that the best way is to carry the screening down about 18″ into the ground. Use aviary netting (which resembles chicken wire with smaller openings) or ⅜″ or ¼″ wire mesh.

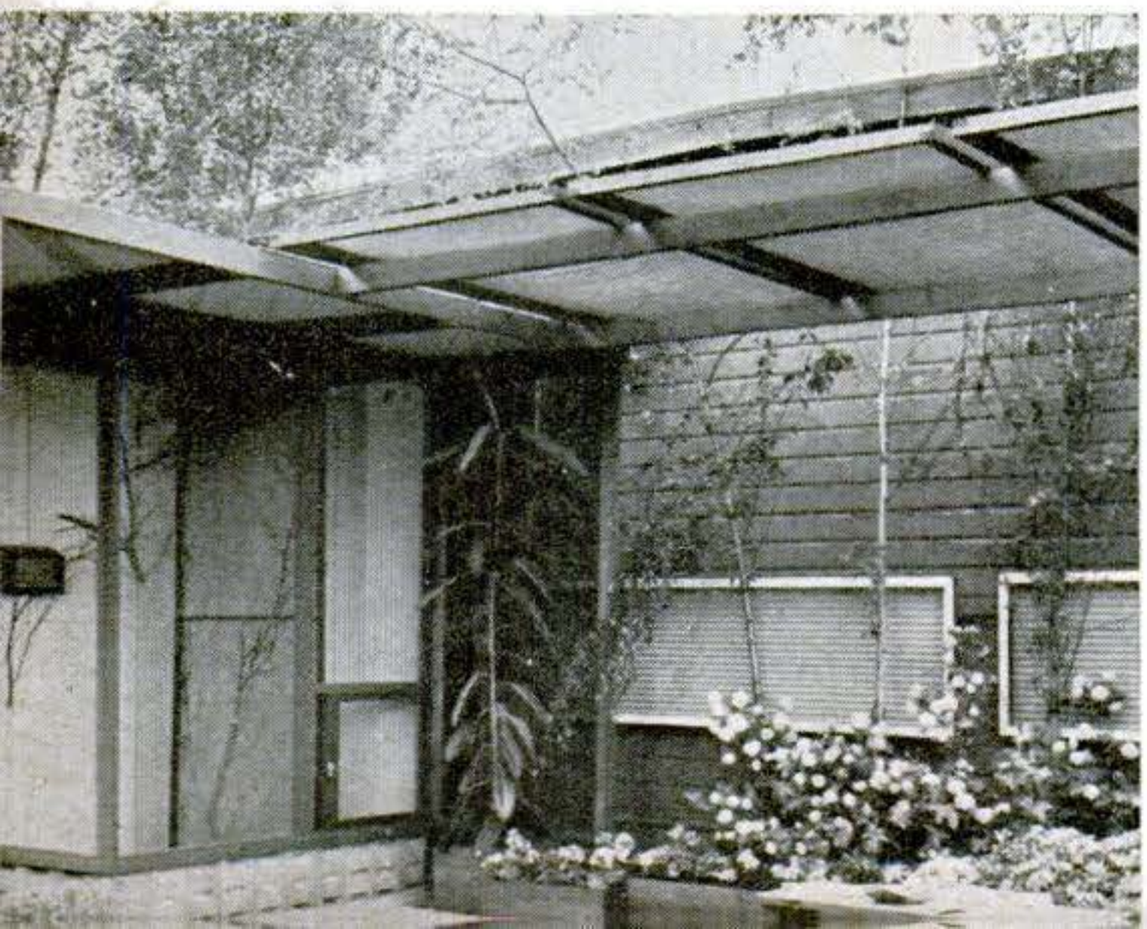
Frame the structure with two-by-threes, two-by-fours or even one-by-two furring strips. Studs can be spaced to suit the width of the screening you use. Aviary netting comes in widths of 2, 3, 4 and 6′.

Every aviary should have a roofed and sheltered corner for the birds, or, in cold climates, a small house with a window or two for ventilation. The windows should be covered, on the side where they don't open, with wire netting.



SHELTERED ENCLOSURE of the small aviary above makes it suitable for use the year round in a fairly cold climate. A two-by-four fence in the foreground protects plants.

OUTDOOR LIVING AREA is combined with this California aviary designed by Ray Coates of Hayward, Calif. Overhang offers comforting shade both for birds and people.



Plain or Fancy—the Birds Don't Care

Inexpensive materials will do to enclose the corner. Sheets of corrugated aluminum make a durable roof and asbestos-cement panels ¼″ thick create walls that require no upkeep.

If you want to make your aviary fancy, with bamboo trim and maybe even a cupola on top, go ahead—the birds won't mind. It won't impress them but if it makes you happy that counts a lot. Both you and the birds will have to live with your aviary.

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Be a Garden Show Spot

A concrete floor can be hosed clean in a jiffy—but it is not essential. Concrete footings and a dirt or sand floor will do well enough.

Birds will spend most of their time in the open part of their aviary, an area called the flight. This must be screened on top—to keep out cats, natch—and should be about as big as the owner can make it. This doesn't mean it has to sprawl all over the lot. A Honolulu aviary 7′ high, 7′ wide and 10′ long is home for 200 finches. That should provide plenty of space for *your* brood.

In general, it is best to make the flight long and narrow to give the birds more room to fly. It should be high enough, 7 or 8′, so the birds can soar over the keeper's head with plenty of clearance when he enters the aviary.

A safety entrance is also a good idea. This consists of two doors, one in a screened cubicle either inside or outside the aviary. This keeps birds from escaping when you enter.

A water supply is essential. A line run right to the aviary is best, perhaps to a drip waterer such as used by poultrymen.

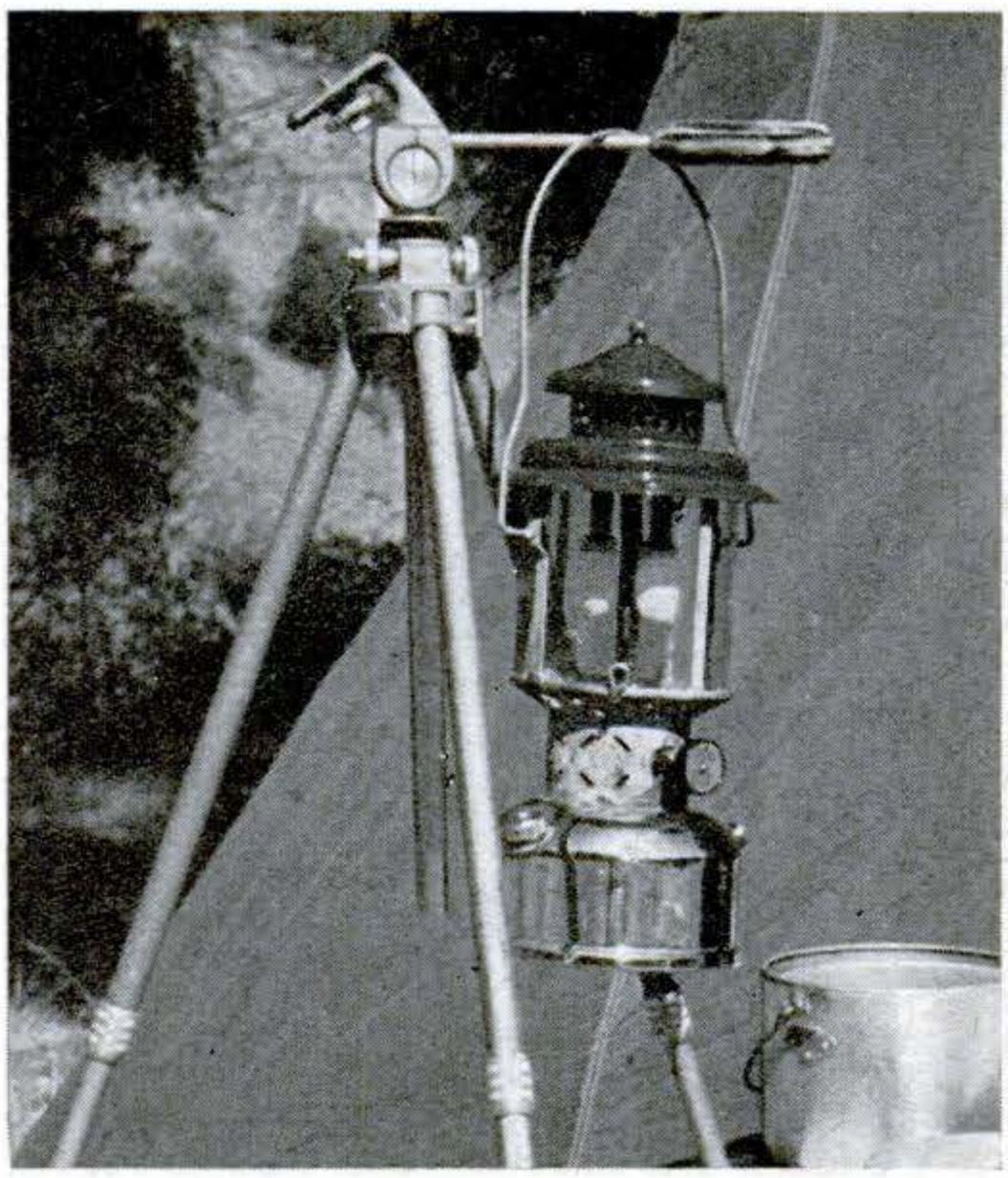
An aviary made of redwood, or one of the other outdoor woods such as cedar or locust, requires no finish to guard it from the weather. If the aviary has to be painted, green is considered the best color. A lighter hue of blue, green or yellow is recommended for the interior. END

A LONG FLIGHT AREA lets the birds stretch their wings. For an outdoor effect, the aviary pictured at the right was built around growing trees, and branches were put inside to provide perches.

LARGE BOXED CAGES are the main feature of the Oakland aviary below, frankly intended as a garden showpiece by Jack Laflin, landscape architect. A lattice roof of bamboo ties the two together.

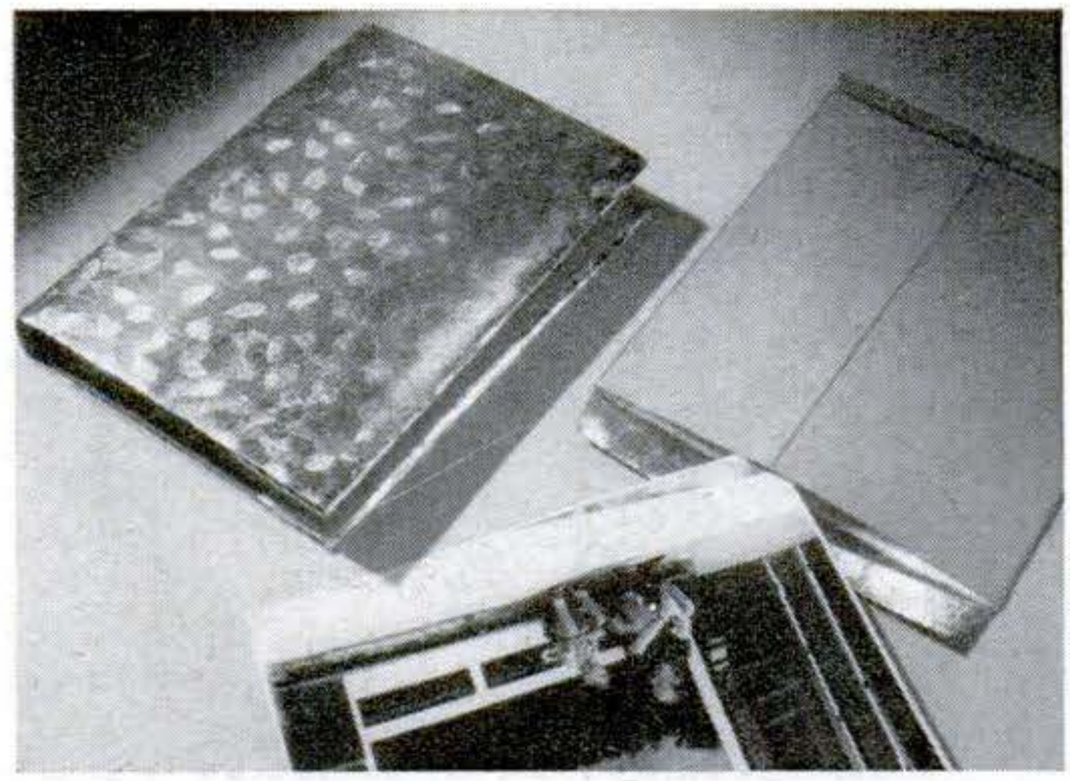
Homemade Rake Cleans Camp

IF YOU like to keep camp grounds neat but can't take along a regular rake, you can improvise one this way. Drive large nails about 2" apart into a narrow board. A forked stick makes the handle, nailed on as shown.—*V. H. Lamoy, Upper Jay, N. Y.*



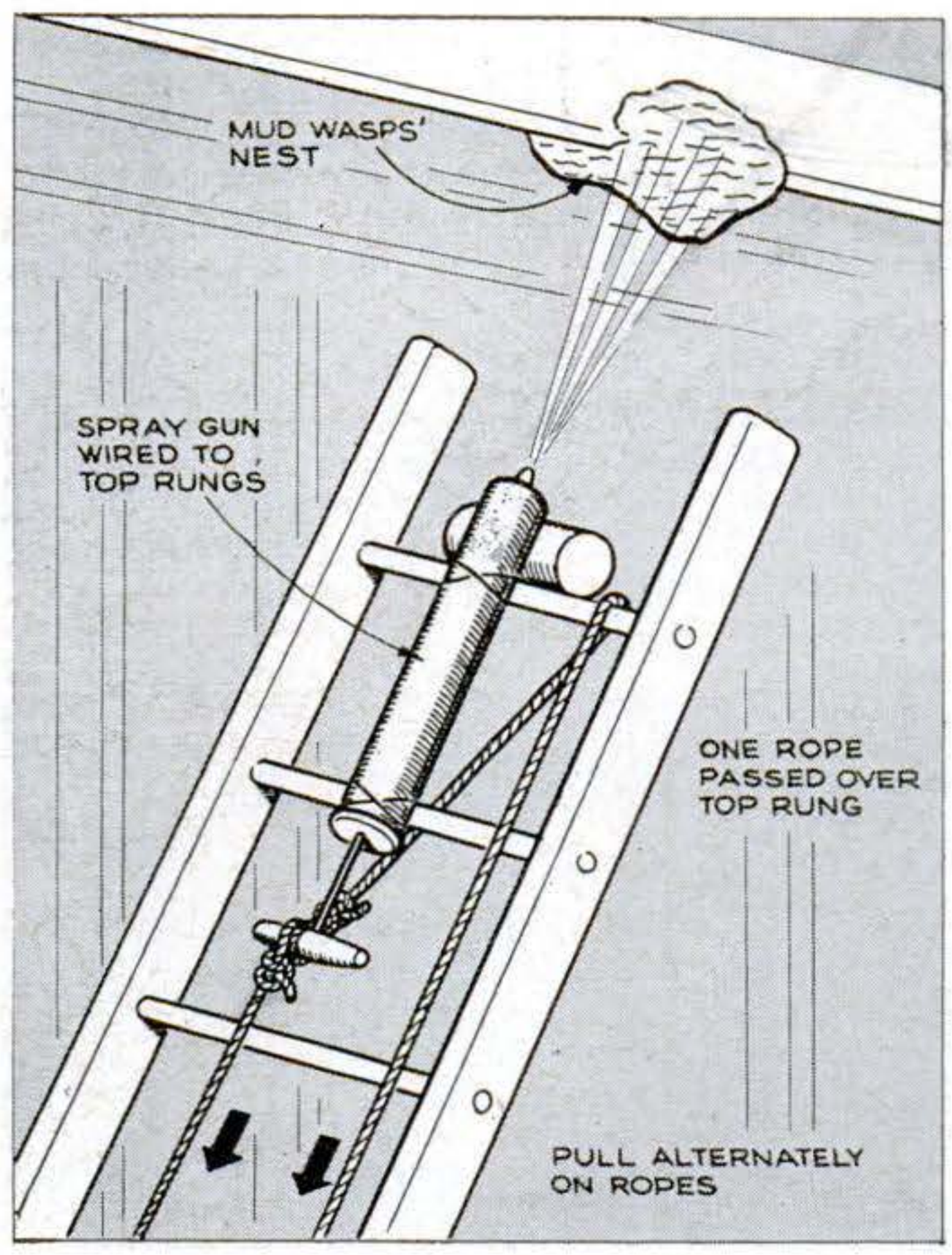
Tripod Holds Camping Light

A CAMERA tripod makes a safe, steady stand to hold a lantern off the ground during camping trips. Hooked over the panhead handle, the lantern can be set at any height and moved quickly around the camp site.—*Shep Shepherd, Culver City, Calif.*



Insulation Saves Books, Photos

ALUMINUM reflective insulation makes an attractive cover for books (left, above) that lasts for years and helps keep out heat and moisture. Envelopes made from the same material, turned shiny side in (right, above), will protect photos and valuable papers. The insulation cuts easily with scissors and can be fastened together with cellulose tape or cement.—*Ken Murray, Colon, Mich.*



Remote-Control Gun Kills Bugs

WIRE a spray gun between the two top rungs of a ladder like this, with one rope leading directly to the handle and the other passed over the top rung. Alternate tugs on the two ropes will then spray a wasp nest with DDT. It works. I've tried it.—*Manfred A. Carter, Hampden, Maine.*

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Cuts clean, accurate designs in wood (up to 1″ thick), light metals and plastic. Wizard 12″ jig saw has full 1″ stroke; trouble-free, oil bath Scotch yoke drive. Sturdy 1-piece cast iron frame. 9⅛″ square cast iron table tilts 45° to right, 25° to left. Enclosed sawdust blower. (2H1102) **$19.75**

5-piece ignition wrench set is ideal for doing work on your car's electrical system, lighting, radios and household appliances. Includes three wrenches with a variety of openings, double-cut file and feeler gauge. Made of case hardened, stamped steel, cadmium plated. (4HR2307).....**37¢**

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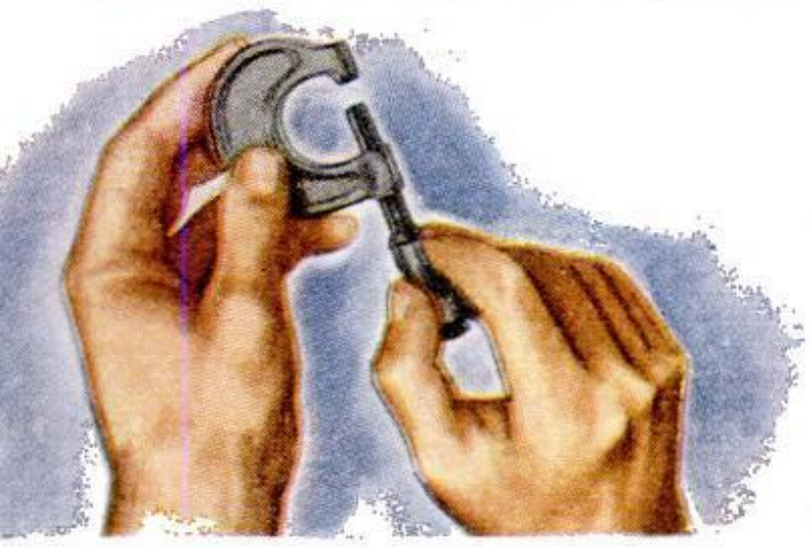

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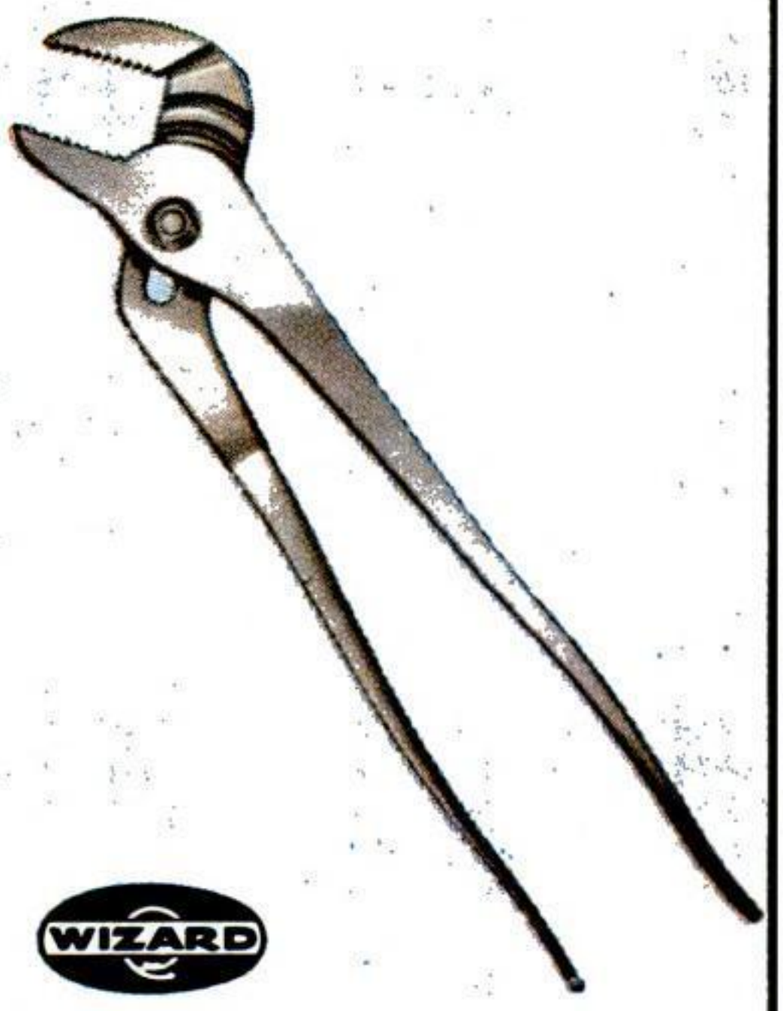

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The new way to set

Ceramic Tile

New adhesives make tiling a do-it-yourself job for anyone, as even crusty old pros take to the stuff in place of traditional mortar.

By Paul Corey and Darrell Huff

FOR solidity, beauty and permanence, it's hard to beat ceramic tile. It gives a sleek job that lasts just about forever.

That has always been true. What is new is the easy way it is now possible to set tile by using adhesive instead of mortar. The new adhesives make the tile work a job that any householder can do himself.

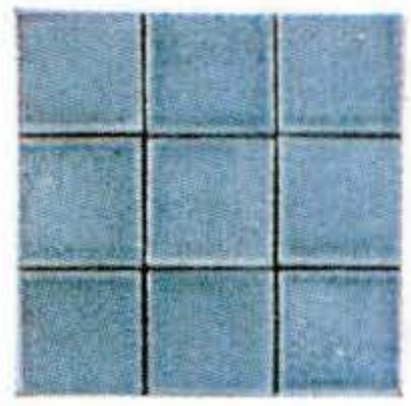
There is one gimmick, however. If your surface is not sound and level you may have to use the traditional mortar method. This is not too difficult when you are tiling a floor or a sink top. The tricky job is using mortar on a wall. Fortunately, most walls can be tiled with adhesive. Even the professionals, in growing numbers, are going over to the stuff.

Planning to tile. Be sure to distinguish between floor tile and wall tile when buying. The floor variety is made to stand up under harder use.

Since each tile manufacturer has his own patterns, the way to choose the types you want is from your dealer's samples and literature. But first you'll have to know what area you are going to cover. For a simple job, merely measure the space so that you know how many square feet will be needed and how much trim, if any.

The "self-spacing" kind of tile is much the easiest to install. It has small projections along all edges to insure even joints for grouting.

If you want to save a good many dollars, buy seconds,



LIVING AREAS of the house can be brightened with tile, as well as the kitchen and bath. Or play possibilities can be built into a tile floor in a game room, as at the upper left. The living room at the bottom left has a tile floor in a random pattern and ebony tile on the walls in and around the fireplace.

TILES VARY widely in pattern and style. Your dealer will help you pick the tile best suited to your job. Be sure to note that tile varies, too, in size and thickness as well as for floor and wall use.

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CLOVER-RED WALL TILE sets the dominant color in this kitchen. Notice that a line of tiles carries the contrasting spruce green of the counter top down face of base cabinets.

MODERN BATHROOMS become more colorful with the help of ceramic tiles. Features that make walls and floor easy to clean are the cove at wall bottom and cap strip at the top.

as these imperfects have all the important qualities of the perfect tile and usually sell for about half the price.

Preparing the surface. Most new surfaces must be sealed before applying tile adhesive. Whether a wall is wood, plaster, or plasterboard, give it a coat of paint primer of thinned shellac. If the wall is already covered with oil paint, it will need no further priming. If there are any cracks, fill them with patching plaster; chip away any soft or broken plaster first. Before tiling around a sink, remove any old linoleum.

Setting the tile. You'll probably use adhesive for any wall job. This method is also suitable for putting tile on smooth floors, and even for sink counters and showers—if you use waterproof adhesive.

With the wall sealed and fixtures removed, choose the most prominent wall for the beginning point. In a tub recess this is the wall running the long way of the tub.

Most modern tile jobs call for straight lines vertically as well as horizontally. For staggered joints, start the second course, and each alternate one, with a half tile.

Grouting is the final step. You buy tile grout in powder form for mixing with water. Use about two parts grout to one of water to form a paste about as thick as pancake batter. Don't mix more than a quart at a time. Let it stand about 20 minutes, then thin it with just a little more water so that you will be able to brush it on. Don't get it so thin that it will run down the wall.

And if you have any grout left over, don't dump it down the sink. It will harden in a trap or drain line as readily as on the wall.

Attaching fixtures. Fixtures to be recessed into a tiled wall are usually available in sizes to match the tile. Just omit one or more tiles (often 1½ tiles) and cement the fixture into the opening.

Such items as towel rods constitute a somewhat different problem, with two solutions readily available. One type of fitting must be recessed into the wall. For this you nibble a corner off one piece of tile. Then cement the metal mounting into opening.

Much simpler to install is the surface-mount type, since it does not have to be placed at a time when you're busy on your tiling job. It can go on when you're through laying tile. This variety comes with screws. Simply drill a hole through the tile for each screw, drilling on through into the wall. Then drive in a wooden plug to fill the hole. Fasten the screws into the plugs.

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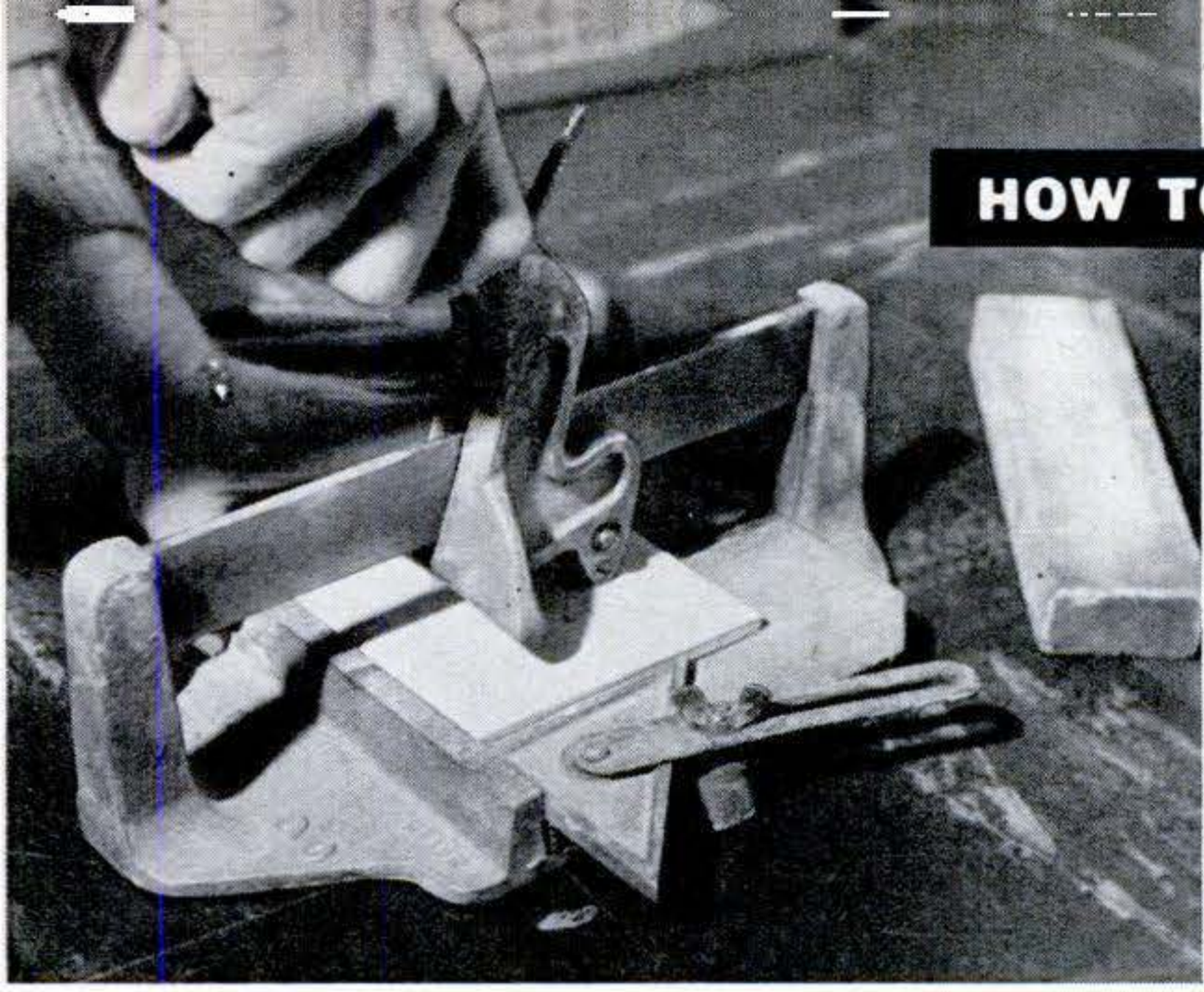
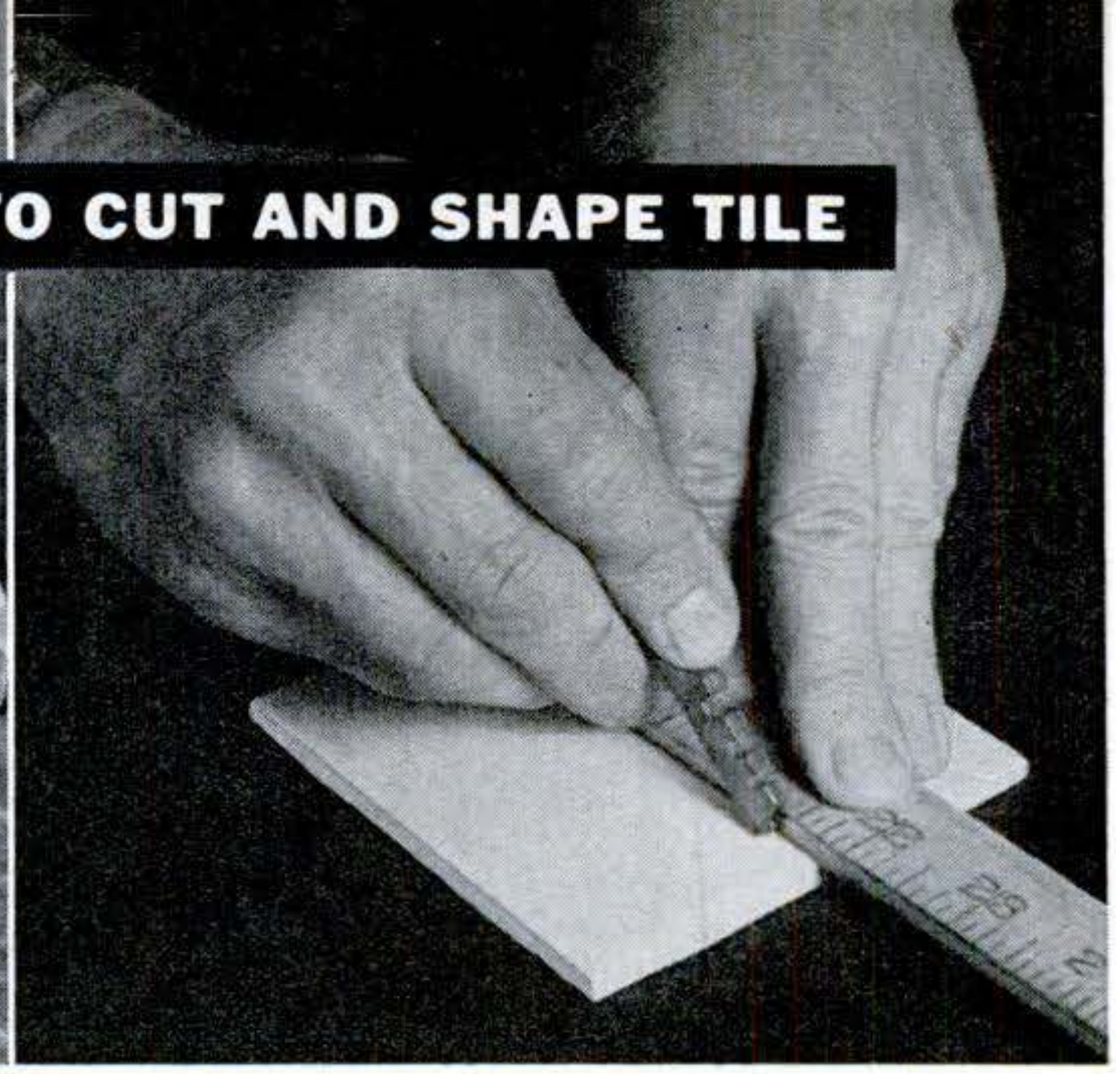
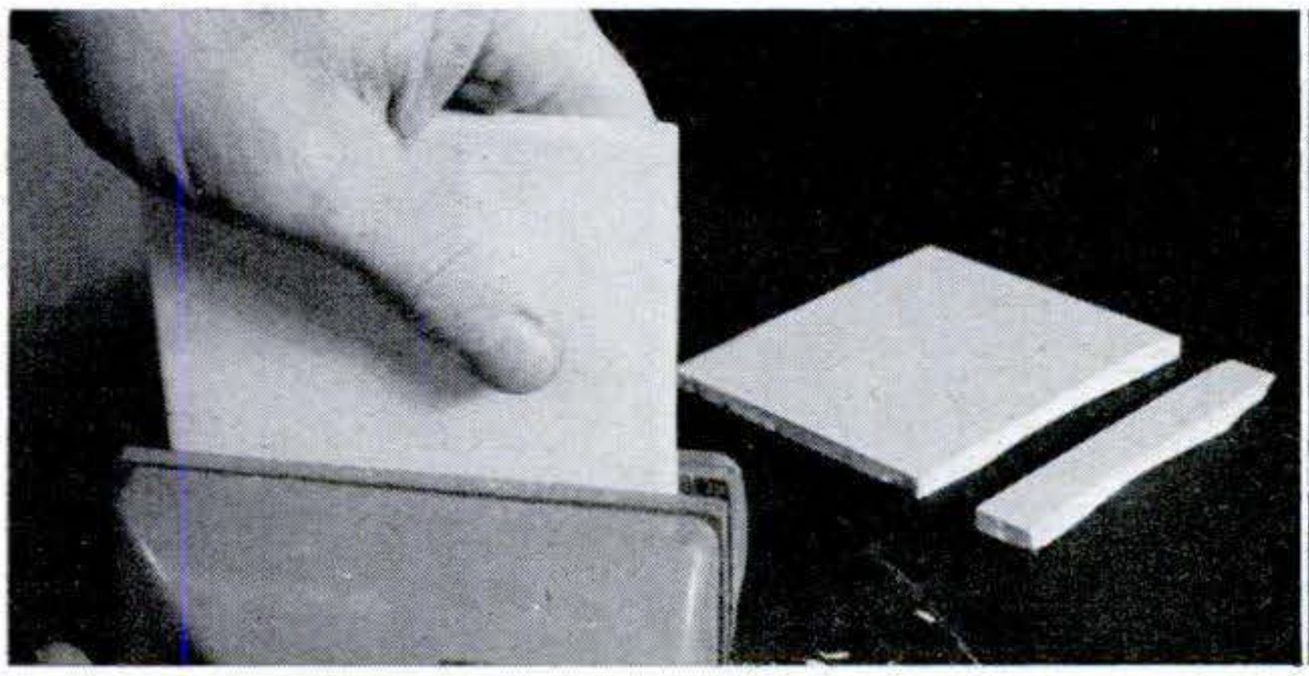
HOW TO CUT AND SHAPE TILE



PROFESSIONAL CUTTER, borrowed or rented from a dealer, scores the tile on glazed side when you pull cutting wheel across it. Depressing cutter breaks tile on score line.

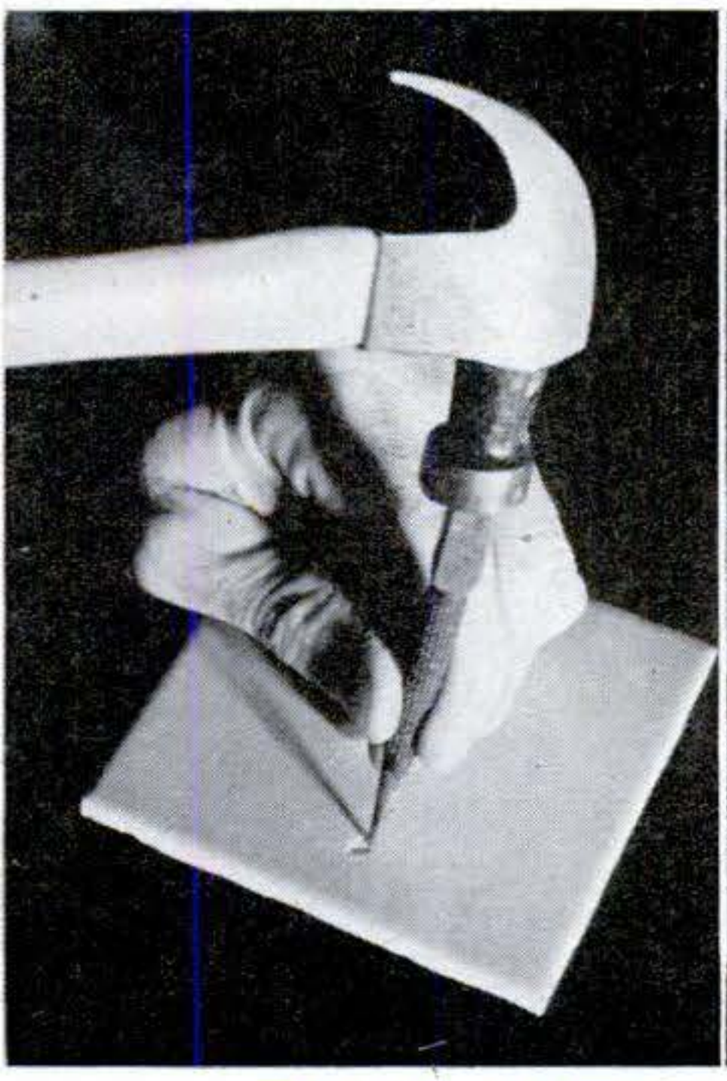


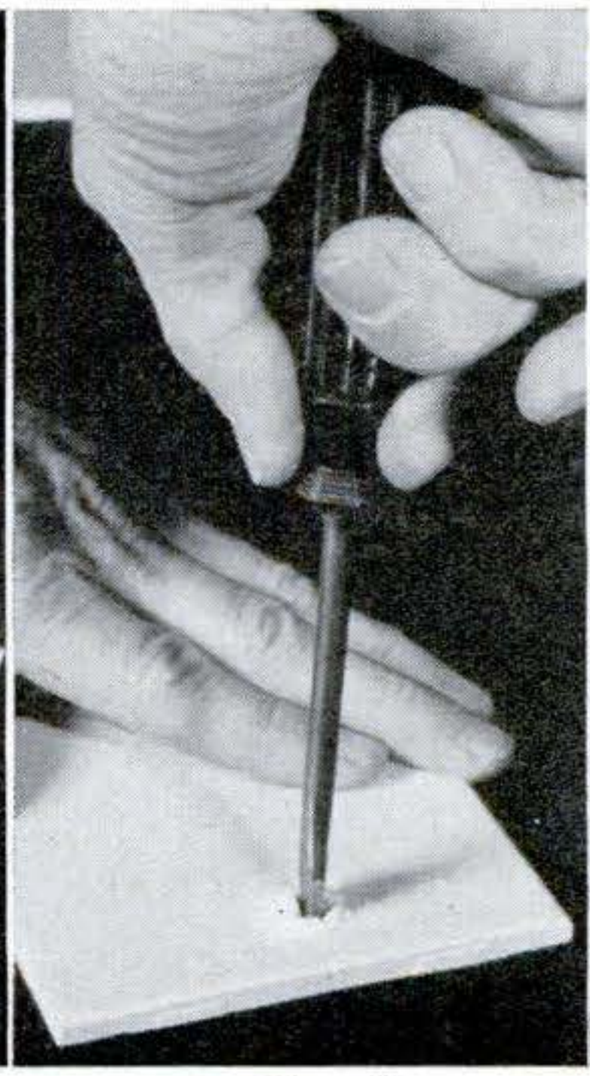
ORDINARY GLASS CUTTER will also do it. Score the tile, place it over a nail or triangular file, and break with a blow of your fist. An ice pick will also score the tile.



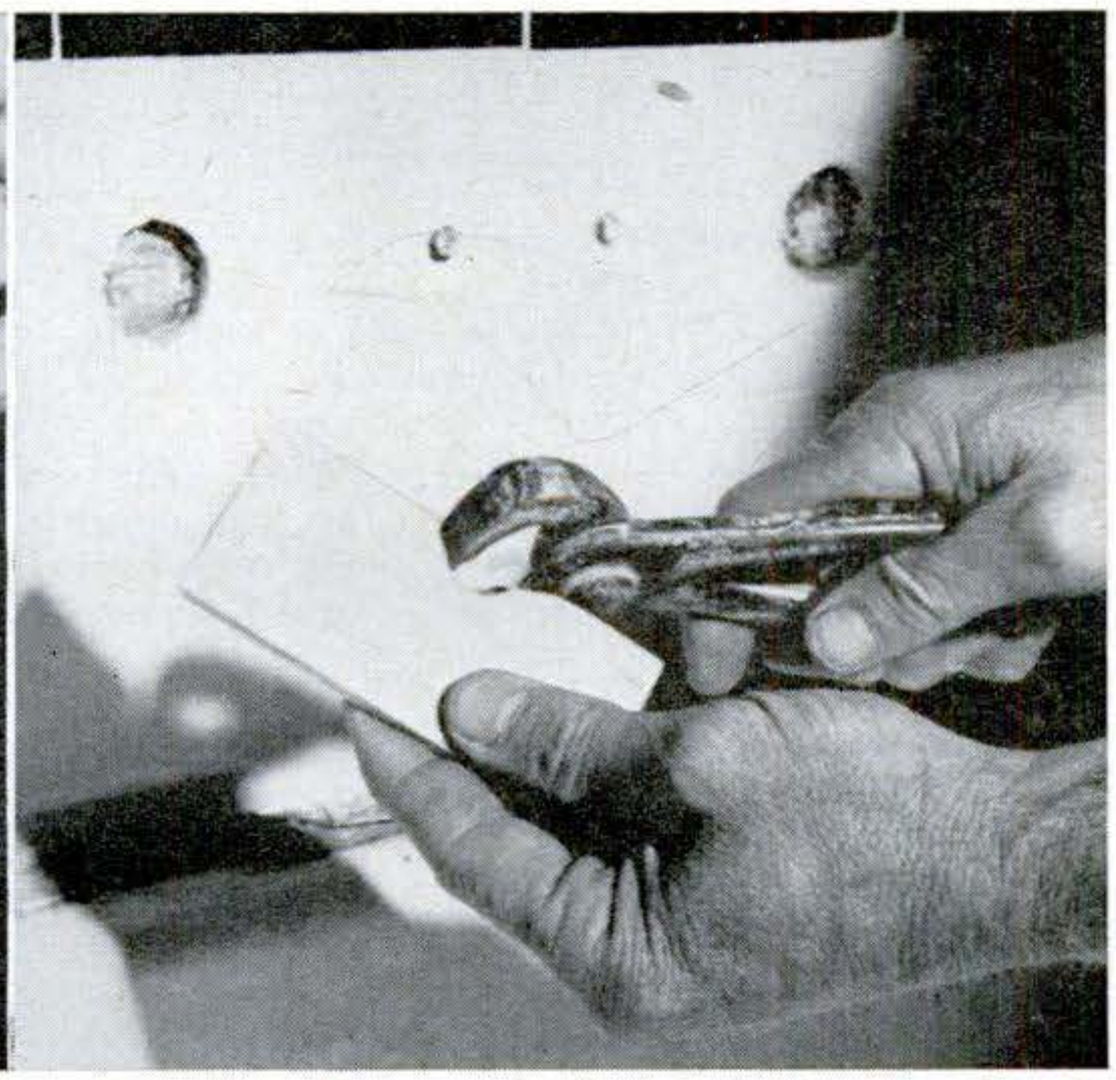
BREAK THE TILE in a vise if the score line is near the edge. Insert narrow strip in the vise jaws and press the upper piece smartly to the side to get a straight break line.

AFTER CUTTING by any of these methods, cut edges must be smoothed. Use a stone as shown here, or scrape with a file or rasp. Or, if you want, use emery cloth on a wood block.





TO MAKE A HOLE in a ceramic tile, chip away the glaze with light hammer blows on a nail set. Then use a screwdriver to dig a hole through the tile, using a twisting motion.



FITTING TILE around pipe calls for cutting it in two. Make a half-circle on each edge, nibbling off a little at a time with pliers or nippers. Pipe flange will cover imperfections.

Please turn the page for more tile photos.

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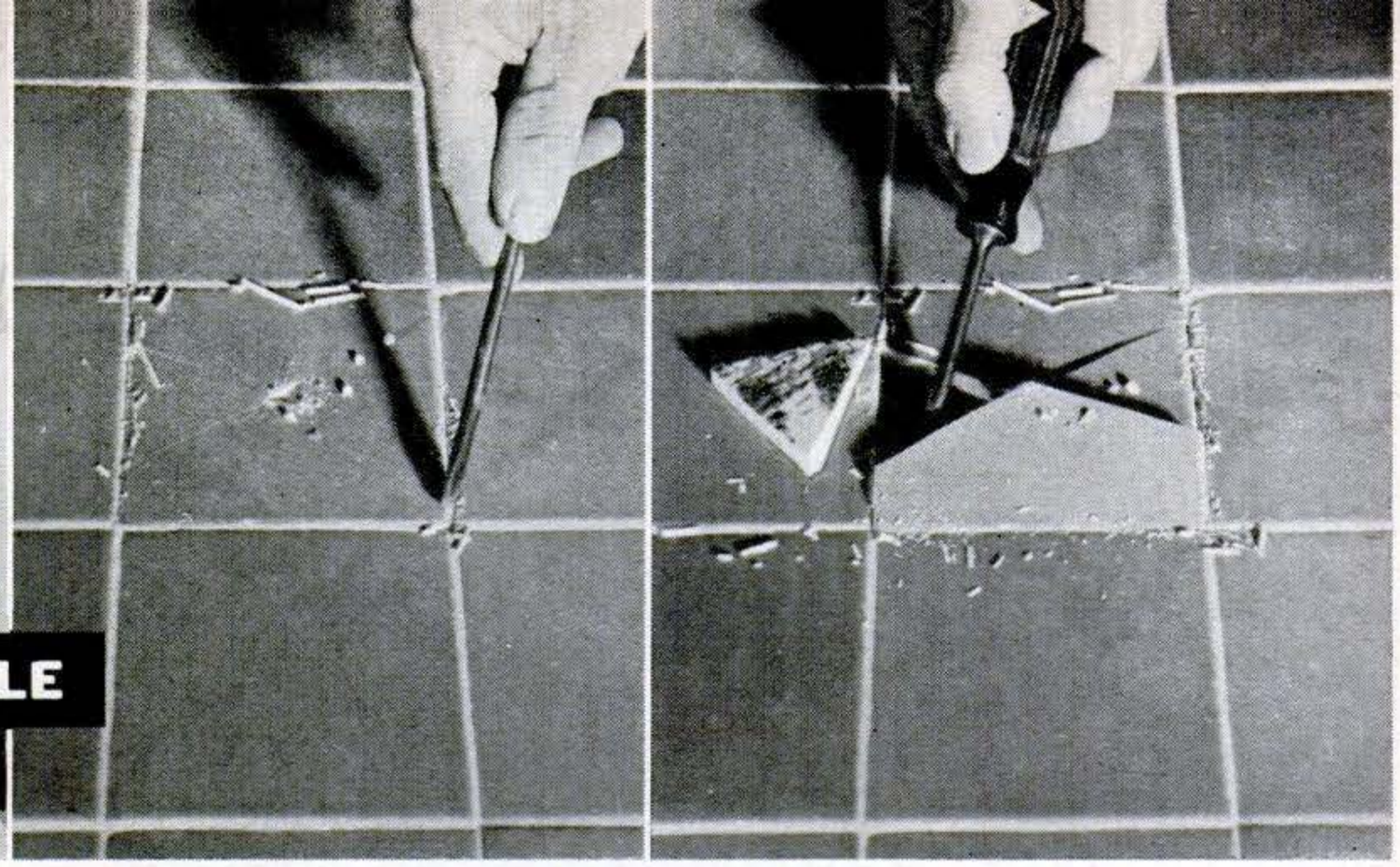
REMOVING OLD TILE

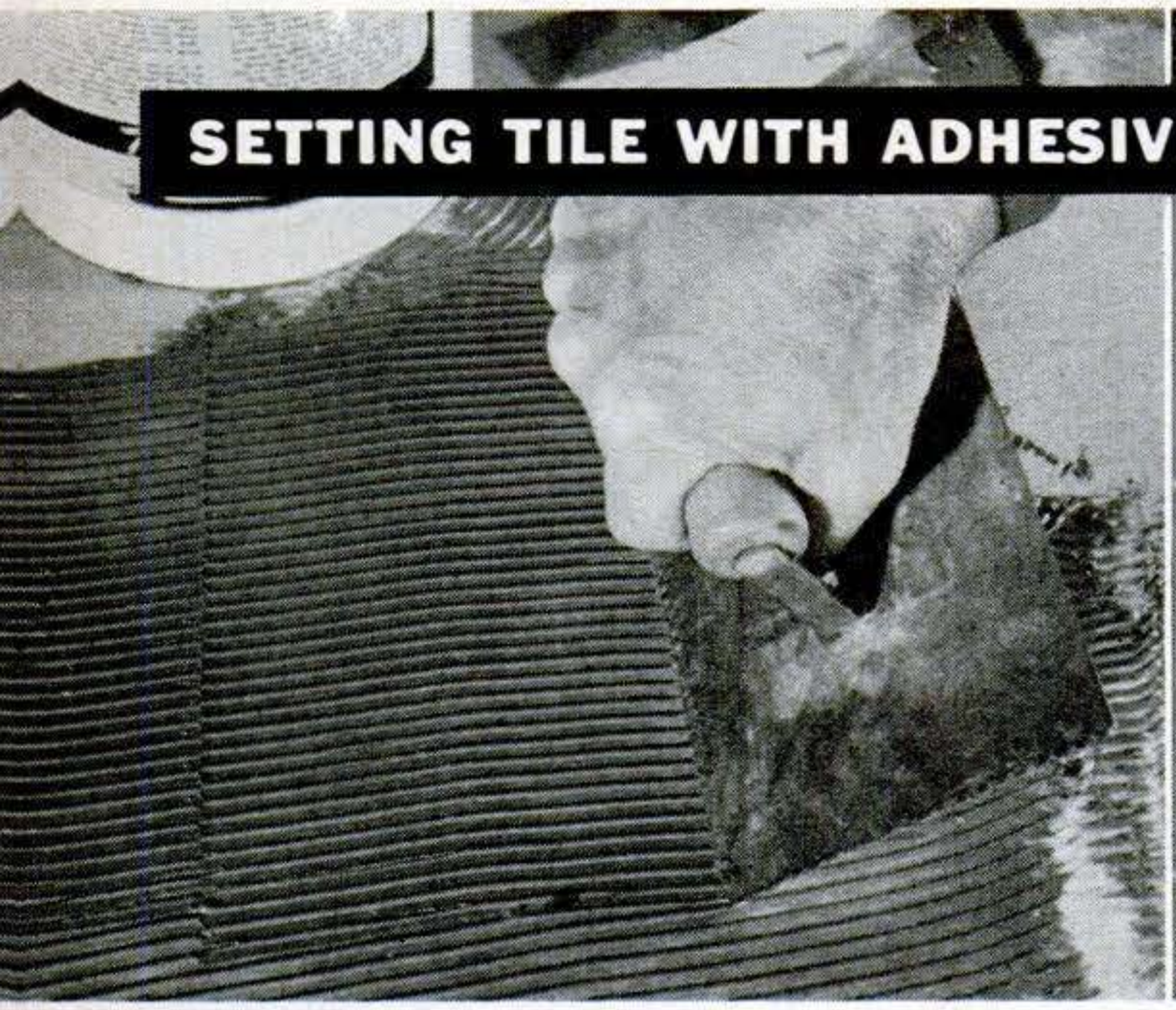


OLD TILE can usually be pried off with an old chisel or a screwdriver and hammer. Stubborn tile can be broken by placing a pointed chisel near corner and tapping.

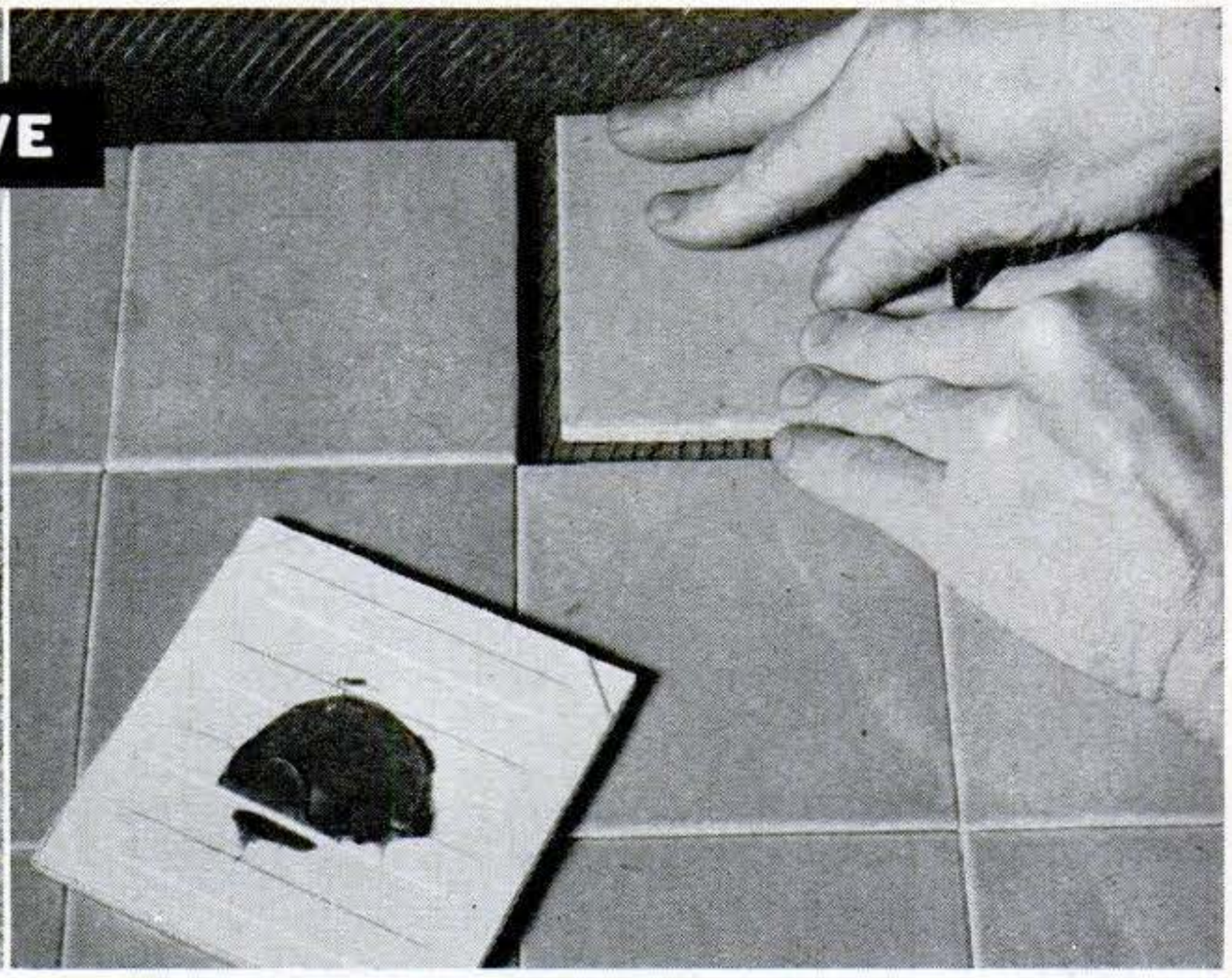
TO REMOVE a single damaged tile, scrape out as much of the grouting between this and adjacent tiles as you can. Then crack the tile by tapping a chisel placed against it.

PRY OUT THE BROKEN BITS. Remove as much of the old adhesive as possible. Then put in a replacement as shown in the tile-setting pictures, finishing up by grouting.

SETTING TILE WITH ADHESIVE



PLACE GOB OF ADHESIVE with putty knife and spread it with a notched spreader, holding spreader at a 45° angle. Go over it again if necessary to insure a thin, even coating.

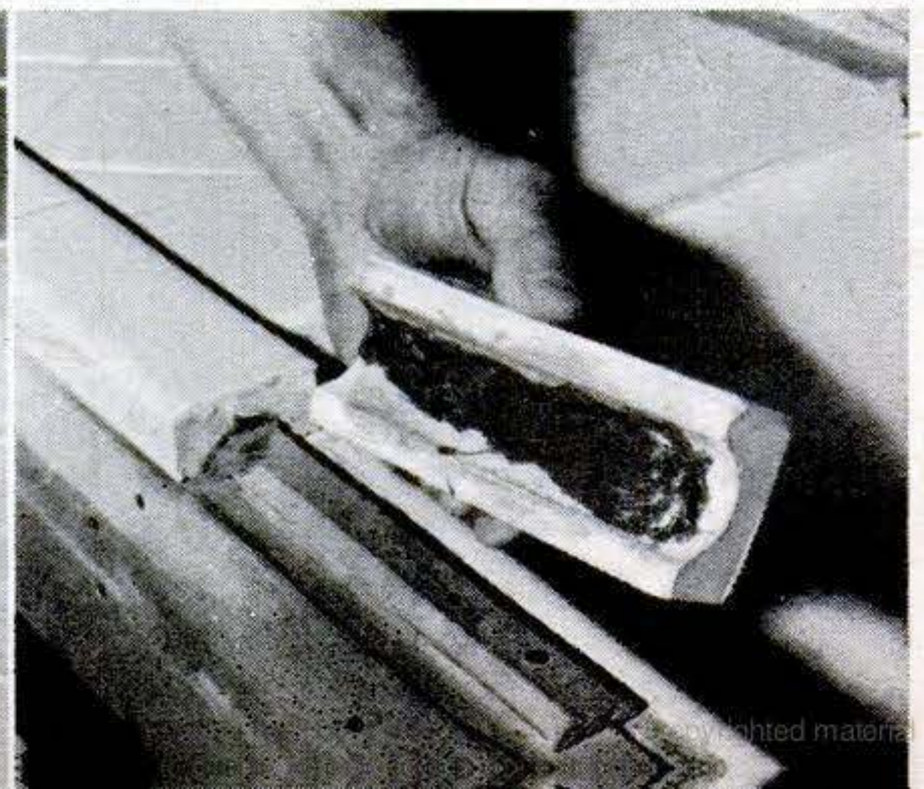


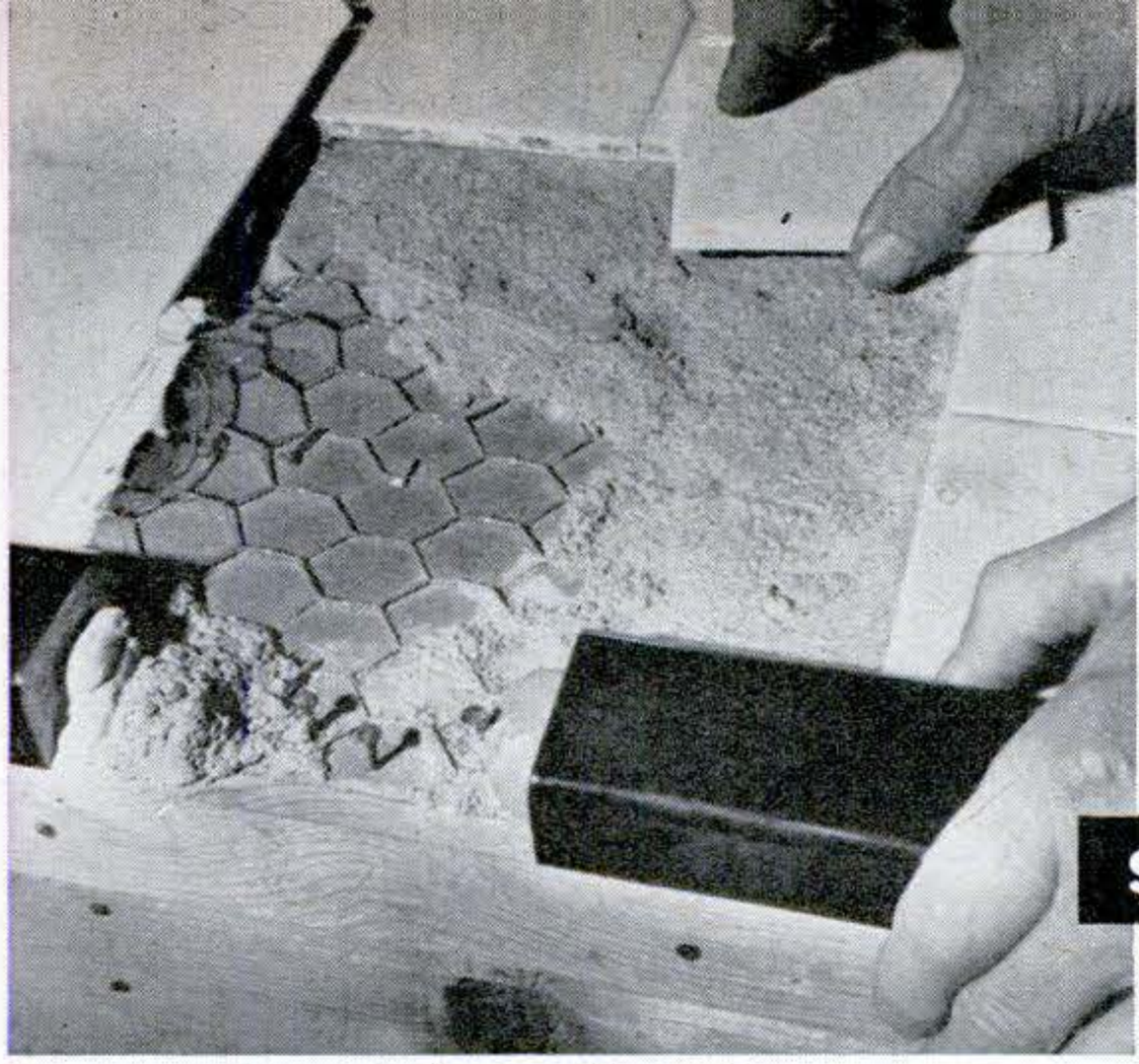
BUTTER A DAB OF ADHESIVE about the size of a half-dollar onto the back of each tile as you set it. Set tile about ¾″ away from where it belongs, then lightly slide it into place.

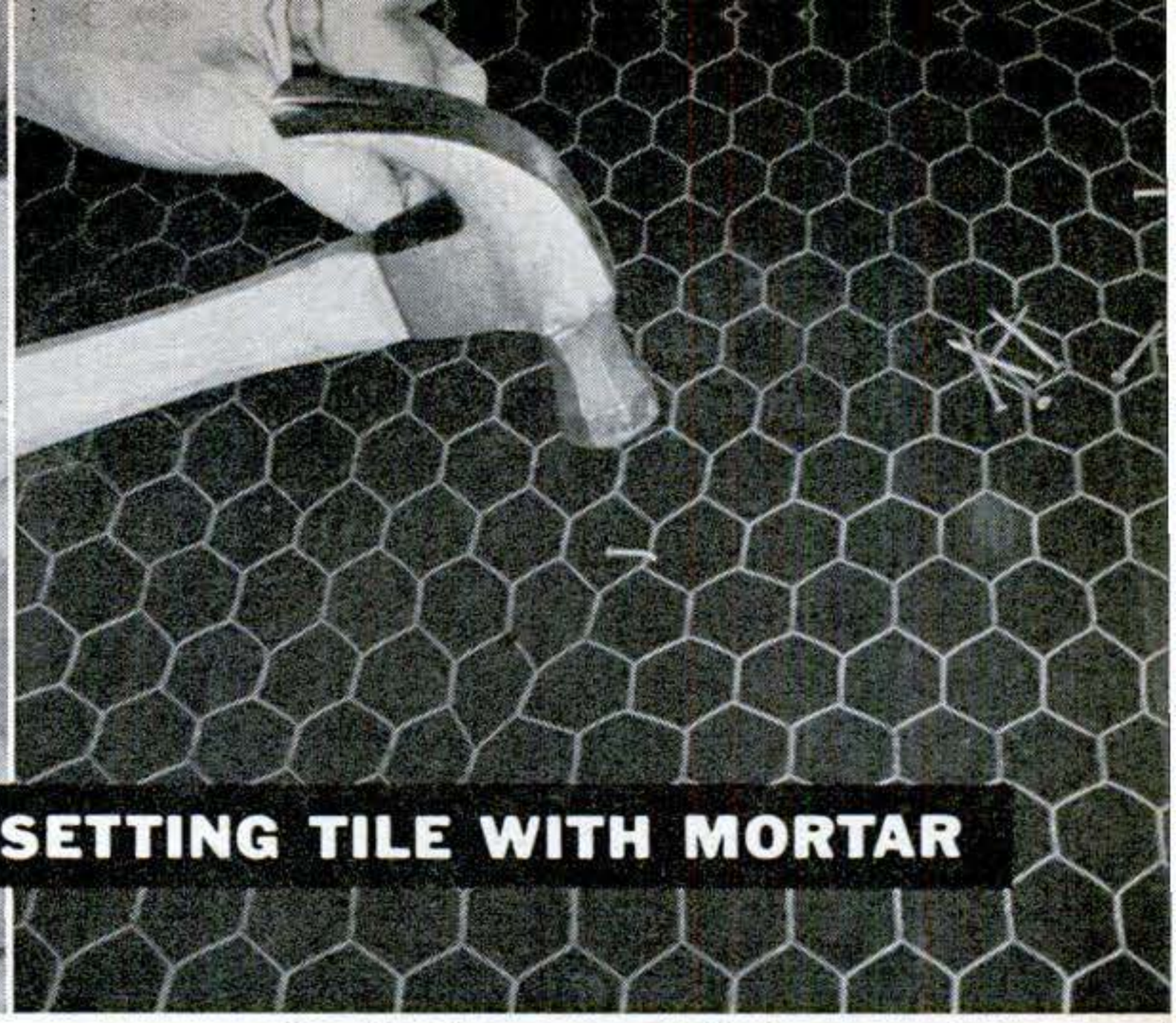
GROUTING may be done at any time after tiles are set. Brush the pasty material on, using a large paintbrush for big jobs. Wash off immediately with a water-saturated sponge.

WIPE with soft cloth. When excess grout is removed, point up cracks with your finger until grout lines are smooth and even. Wipe again with a cloth so face of tile is clean.

USE only waterproof adhesive if you cover a sink top by adhesive method. Before placing other tile, set sink cap tile over molding. First, spread adhesive evenly on molding.



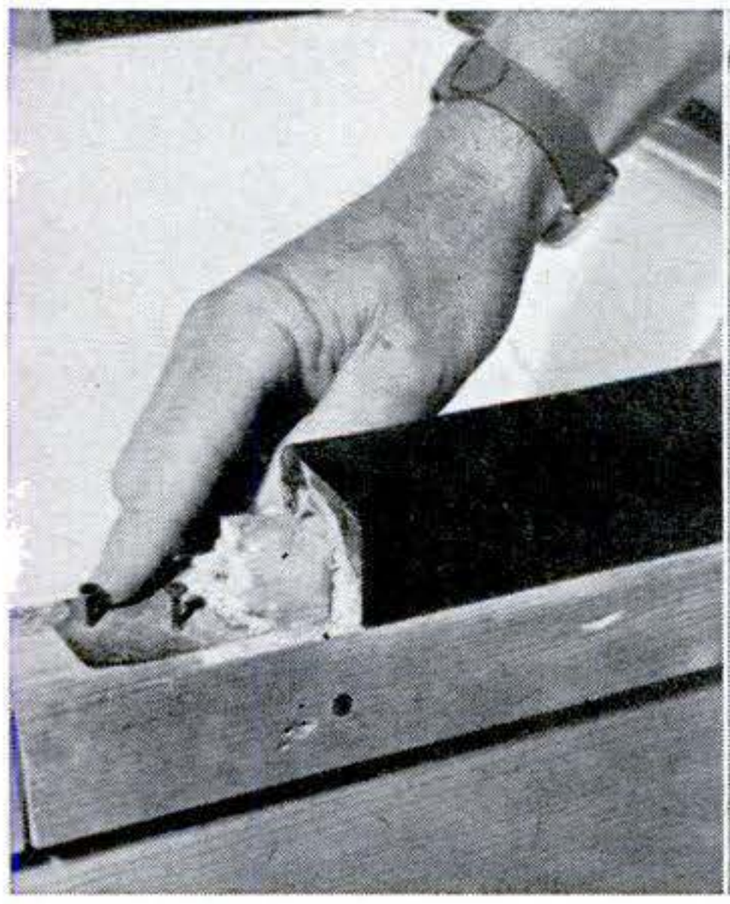


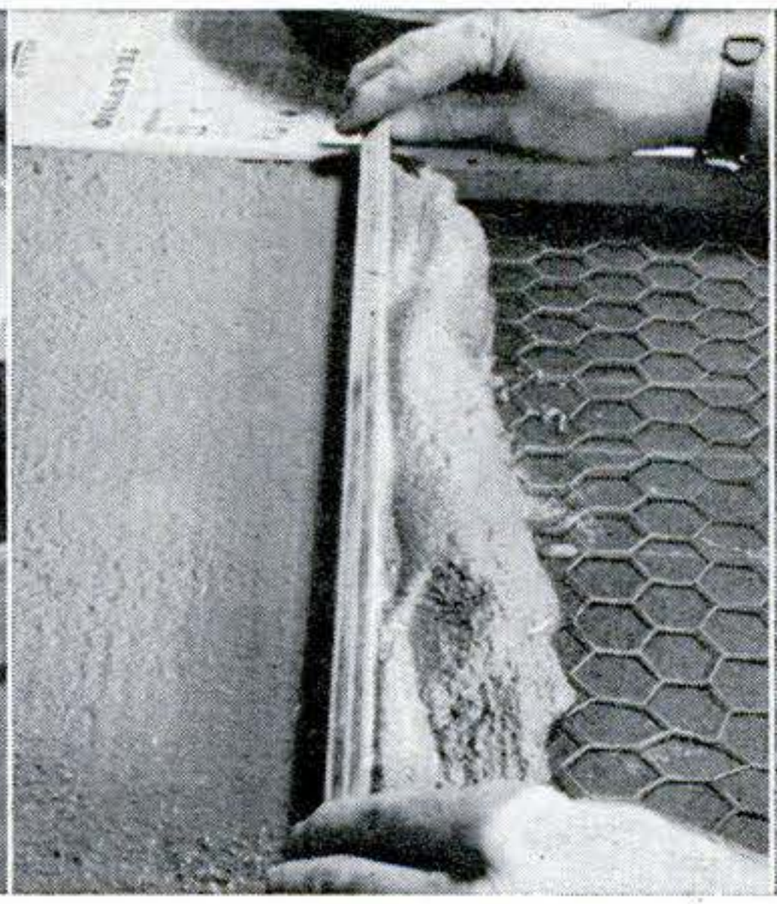


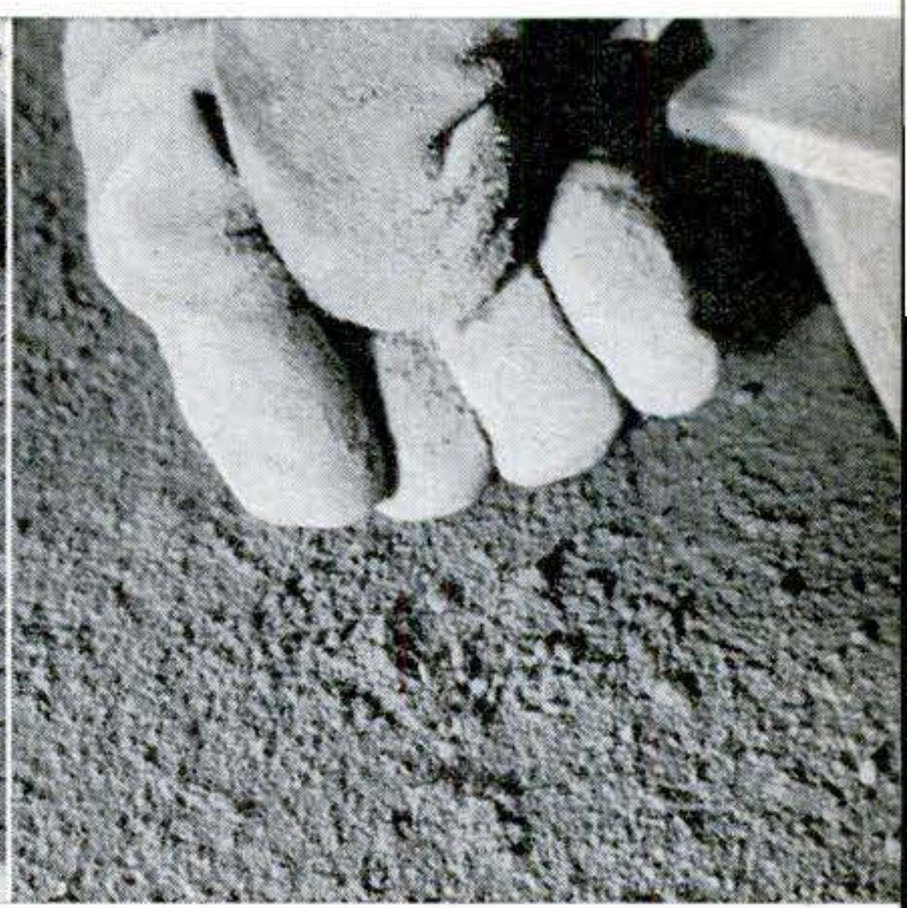
SETTING TILE WITH MORTAR

CUTAWAY here is designed to show a cross section of tile set in mortar—as for a sink top. The wood base is covered with tar paper; chicken wire forms reinforcement for the mortar.

FIRST STEP in tile-in-mortar job is covering wooden sink top with waterproof building paper. Fasten 1″-mesh chicken wire with galvanized nails every 8″ and bend them over.







PLACE SINK CAP, or outside edge, first, as shown above. Staggered row of galvanized nails should stick up ½″ or more. Spread cement mortar. Apply skim-coat cement (portland cement and water mixed to a thick cream) to back of tile and press over mortar.

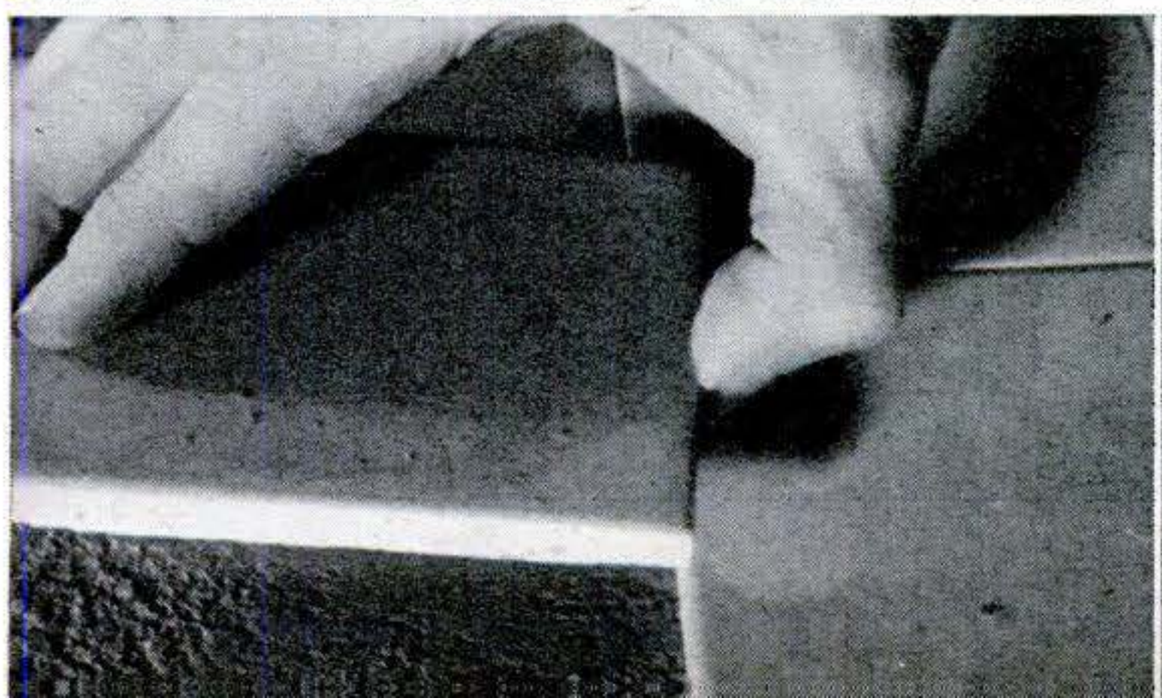
OVER BUILDING PAPER and chicken wire place ⅜″ wood strip at edge of sink as guide for thickness of mortar. Place other strips every 4′ or less, making them high enough to give at least ¼″ pitch toward the sink. Mix mortar and strike off as shown here.

REMOVE STRIPS and fill gaps with mortar. If you intend to use quarter-round at edge of sink bowl, the wood strip there may remain until you are ready to place the quarter-round. Now dust a thin layer of dry portland cement over surface of the mortar.

TILE SHOULD BE PRESOAKED for one hour and then permitted to drain on a clean board for five minutes before setting. Set tile on top of the prepared mortar bed, starting inside the sink cap and next to the sink, and working down toward the end and rear of the drainboard.

USE BEATING BLOCK as shown here to smooth the tiles and press them into the mortar. If any tile is too high or too low, remove it and take out or add a little cement. Reset the tile and tap into place. Finish by grouting.

(Please turn the page.)



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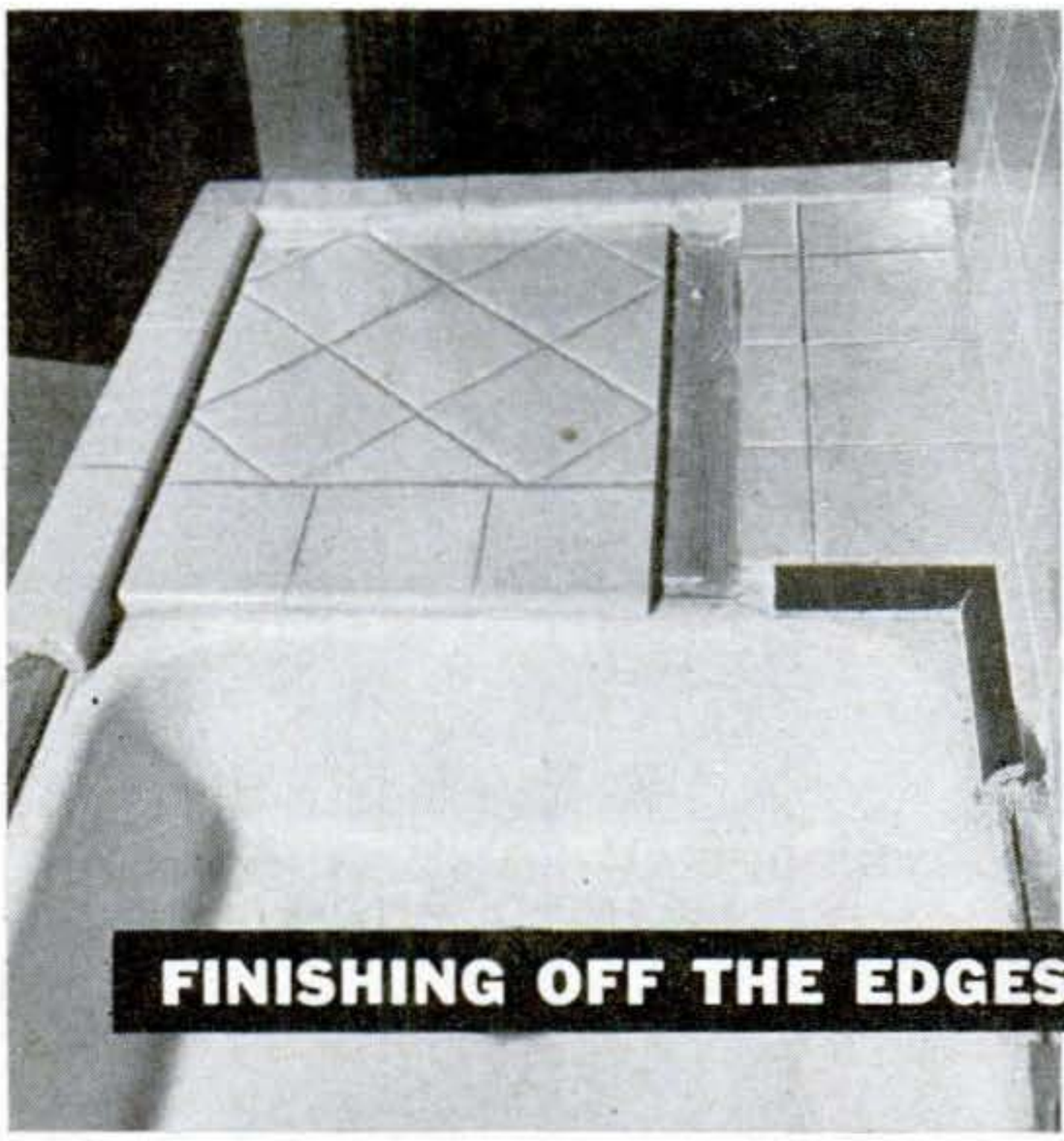
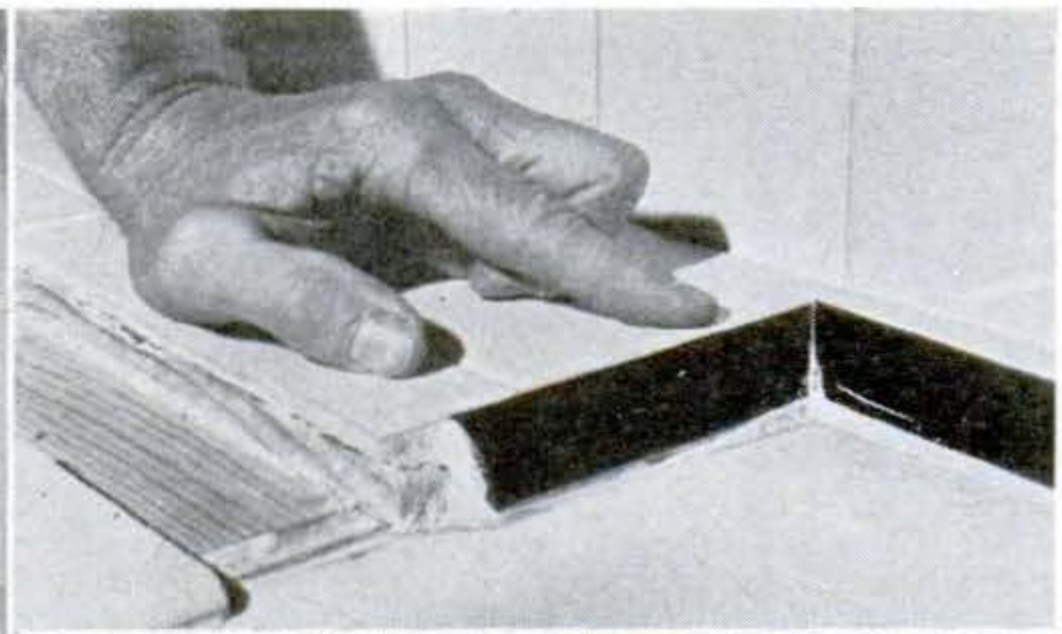
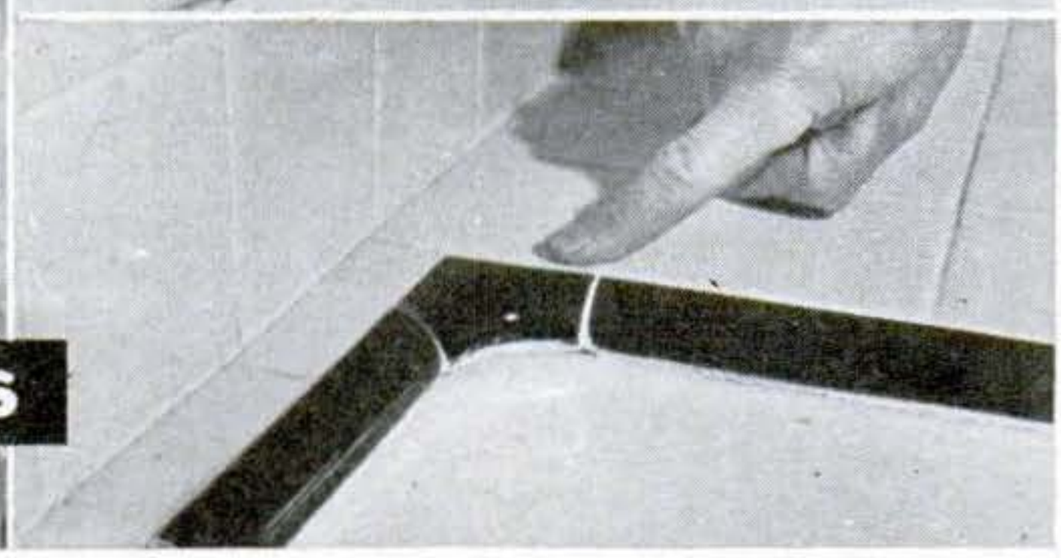


FINISHING OFF THE EDGES





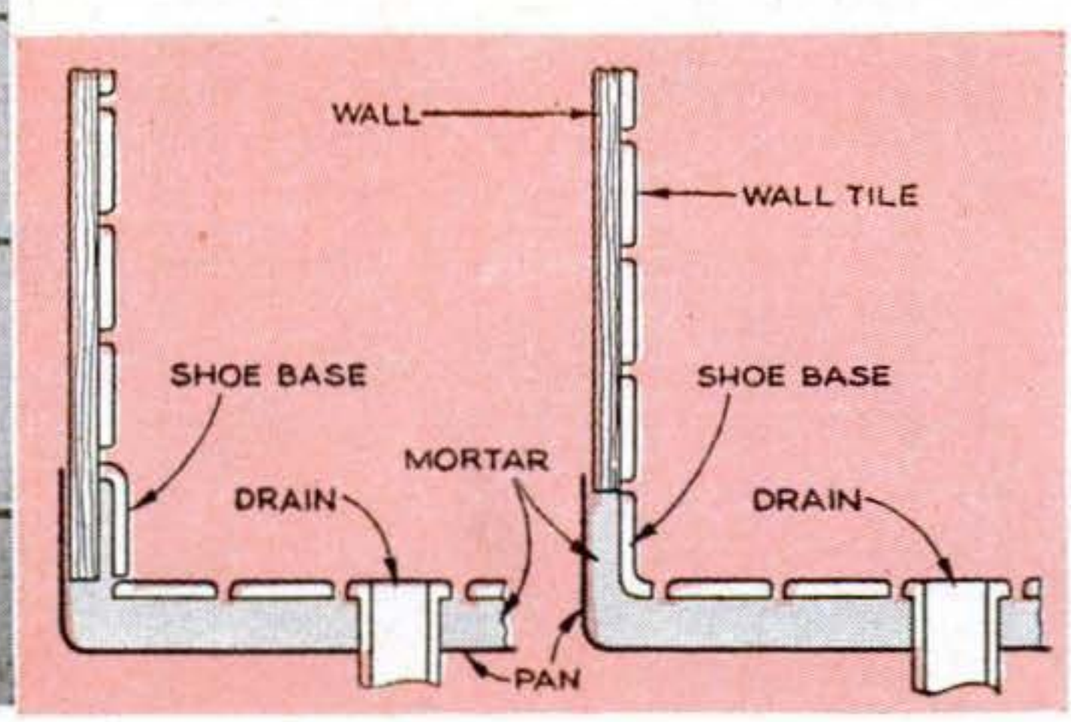
DEMONSTRATION SINK shows two methods of finishing tile at edge of sink. Method at left uses bullnose tile without trim of any kind. At right side of sink quarter-round tile is used. This is placed after buttering back of tile with pure portland cement paste.

ALTERNATE METHODS of fitting quarter-round at corners are shown here. The upper one calls for mitering quarter-round. Dealer will make this cut, or you can do it yourself with a reinforced cutoff wheel on saw. The other method uses a special corner tile.

TUB AND SHOWER DETAILS

DEMONSTRATION at right shows how to tile in an old-style bathtub. Dealer cuts special tile shapes to your paper pattern. As cutaway indicates, tub is framed in, plywood covered. Regular tile is set with adhesive. For tub edge, use mortar or waterproof adhesive.

ITEMS BELOW make tiling your stall shower easy. A shower pan of reinforced waterproof paper goes on the floor. The drain is the same size as standard tile. The sketches at bottom right show two different methods of arranging the tile where wall meets floor.



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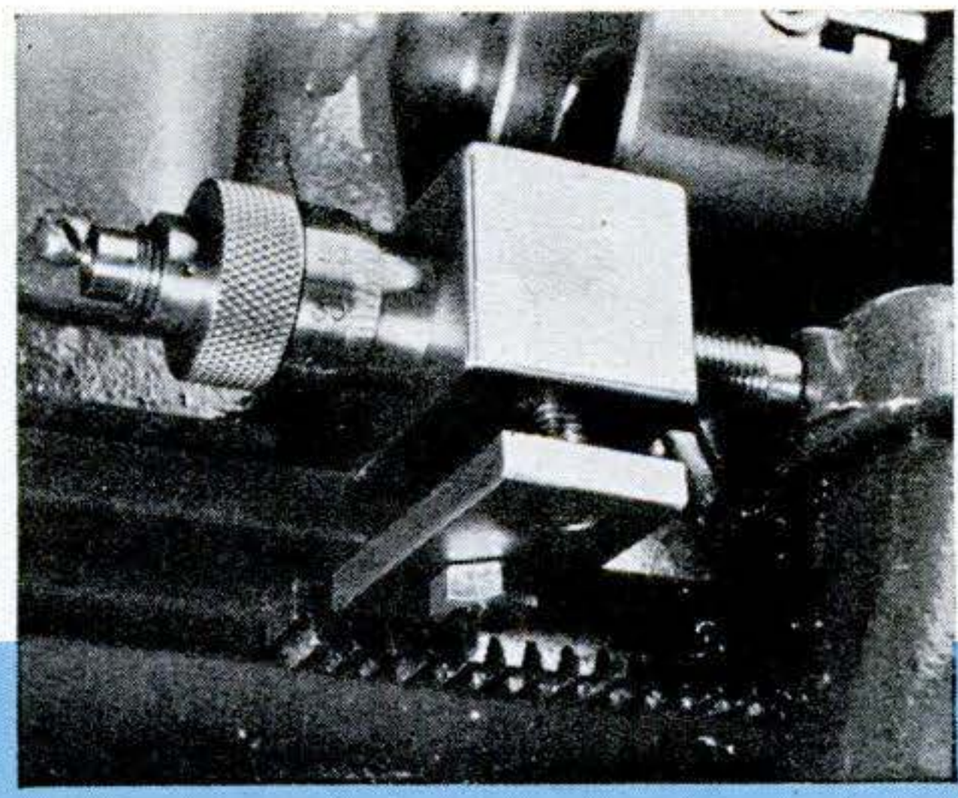
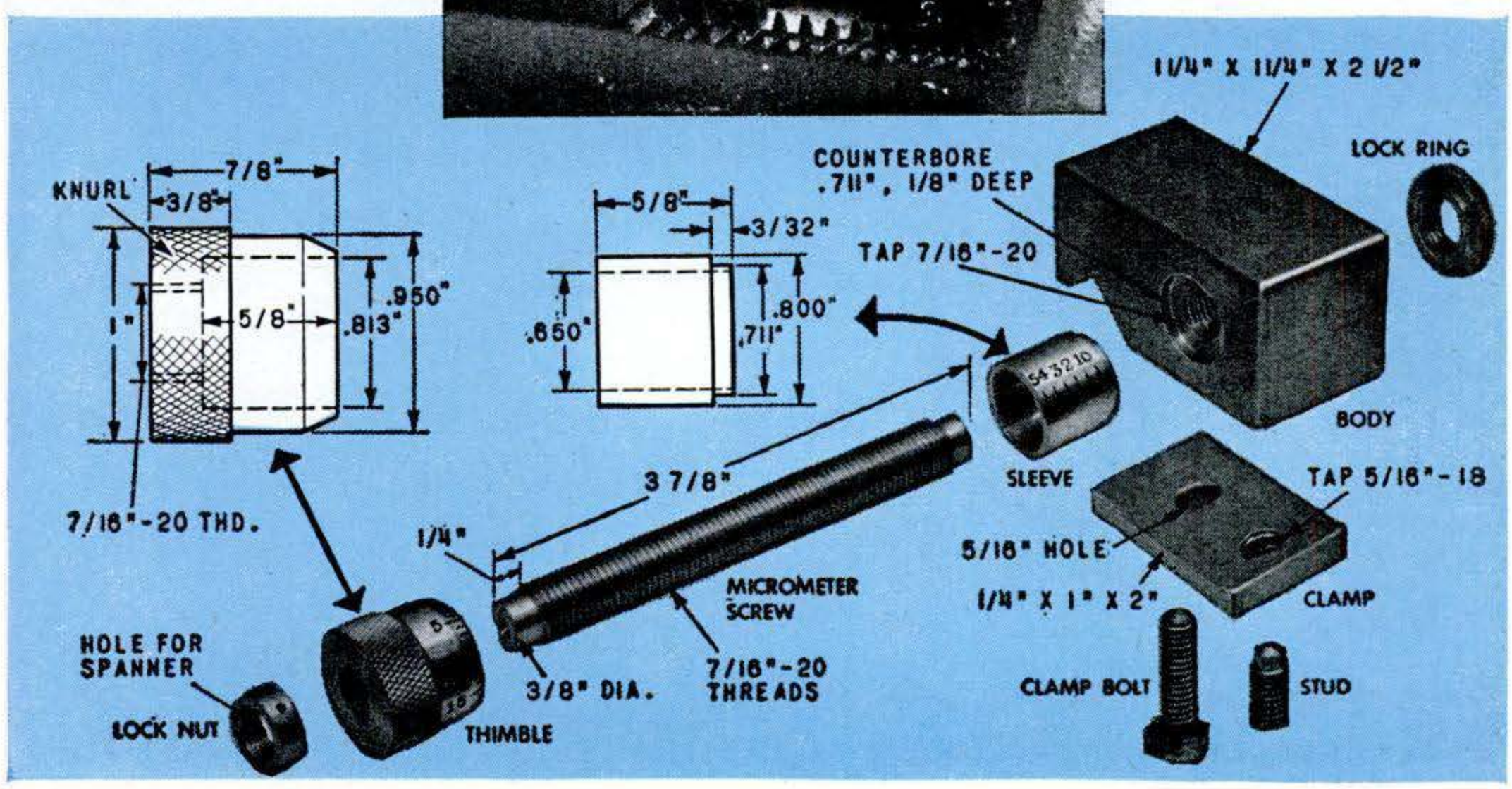
CHECK THE LOCATION of the carriage-stop pads on your lathe in relation to the ways, and lay out the body accordingly. The short stud at the front of the clamping plate enters a shallow recess in the body. Set it for effective clamping. Then loosen just the bolt to slide the stop into place.



NEW Shop Ideas



Micrometer Carriage Stop. Rugged and accurate, this device clamps on the lathe ways either side of the carriage to limit its travel for duplicate facing, accurate boring, or milling. With it, I have milled a ⅜" groove around a turret body within .002".

Mill, or saw and file, the V notch to fit your lathe (for flat ways, make the body longer to hook over the inside edge). Drill undersize, bore to .390", and make the .711" counterbore. Start the tap in the tailstock chuck to insure a straight thread.

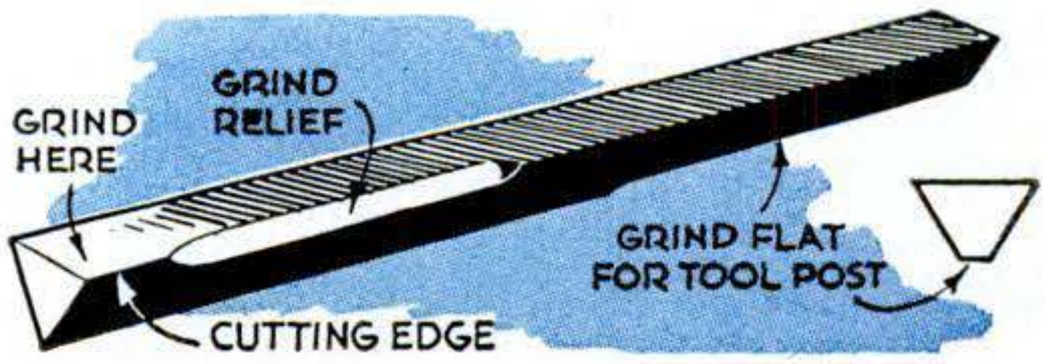
Cut the screw on the lathe using the tapped hole in the body as a thread gauge. Round off the ends of the screw.

Graduate the sleeve by setting the compound rest parallel to the ways, with a V tool in the post. Scribe the horizontal line first, and then vertical lines .050" apart, gauging them by the compound feed collar.

To graduate the thimble, mount a small 50- or 100-tooth gear on the end of the stock before boring it out. Index by running the tool against the teeth; then feed in to scribe the lines.

The lock nut clamps the thimble to the screw. Drill the nut to fit a small spanner wrench. The knurled lock ring at the other end keeps chips out and locks the screw.

To align the zero marks on the sleeve and thimble, it may be necessary to face off the shoulder of the .711" diameter slightly. I found that with the edge of the thimble at the zero on the sleeve, the thimble read 15. Facing .015" off the sleeve shoulder made the zeros coincide.—*Harry L. Edwards, Scranton, Pa.*



File as Boring Tool. Having centered a gear in the lathe to fit it to a shaft, I found I had no drill or reamer the right size, nor a boring tool small enough for the job. A triangular file, ground as shown above, met the emergency. Being already hard, it required no heat treating. It worked better than any small boring tool I had ever used. —*John B. Underwood, Berkeley, Calif.*

Please turn the page for more shop ideas.

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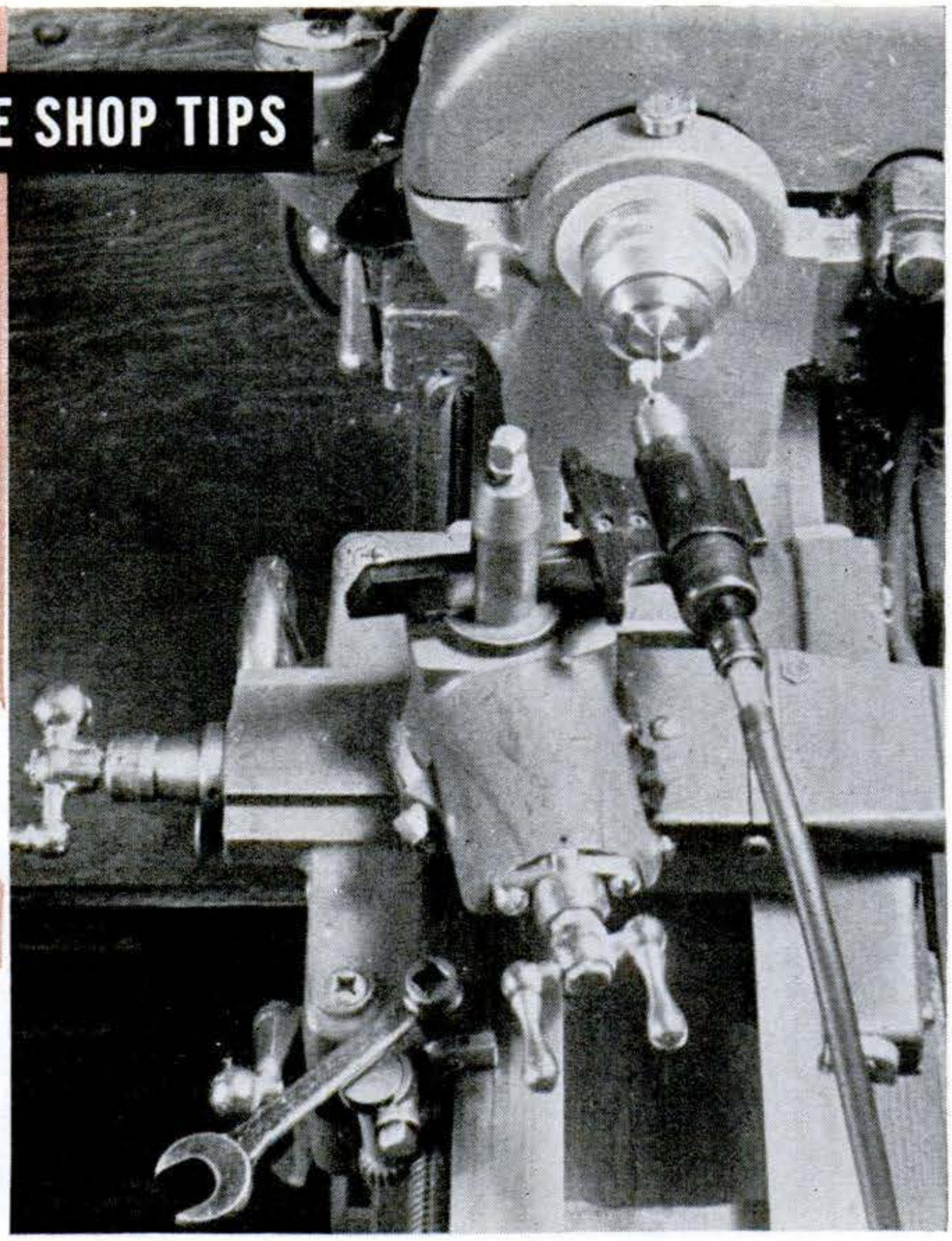
MORE SHOP TIPS



QUICK ADJUSTMENT to any work height is possible by sliding the handpiece mount on the column. A U clamp fixed to the bottom of the column holds it upright on the bench edge. The motor should be hung to keep the flexible shaft as straight as possible.

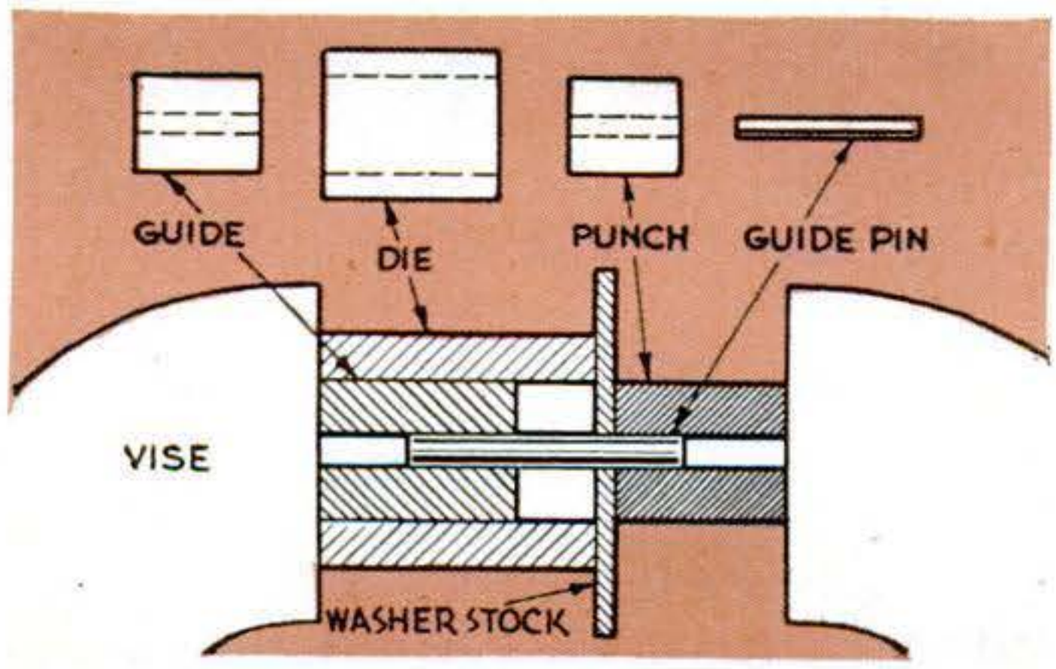
Flexible-Shaft Uses. In building a model, I needed both a sensitive drill press to make holes down to No. 80, and a light-duty tool-post grinder. My high-speed flexible shaft doubled for both.

Having an old microscope rack-and-pinion movement, I made a clamp to fit the shaft handpiece and bolted it to the rack member. The entire movement was slid over a ⅝″ steel shaft, which happened to fit the lens barrel nicely. A wing screw was added to clamp it at any point.

For the table, a small, thick steel plate was drilled ⅝″ and fitted with a setscrew, making this also adjustable so that the work can be raised if desirable.

Instead of a microscope movement, an old bottle capper would make a good mount. The handpiece will have to be mounted on the side of the plunger. Blocks will raise the work to a suitable height.

For tool-post grinding, the handpiece was clamped with a sturdy strap to a ⅜″-by-1″-by-5″ steel bar. This was mounted in the lathe tool post as shown at the right above. The flexible shaft was run off horizontally and its motor laid on the bench.—*Andrew Pfeiffer, Old Lyme, Conn.*



Washers Made in Vise. Odd-sized washers can be punched out quickly with this tool. Make at least the die and the punch of tool steel and harden them. Drill or punch the center holes in the washer stock. Then clamp in a heavy vise as shown so that the guide and the pin, which must be a good sliding fit, line up the parts. Tighten the vise and a washer will be punched out. Lubricate the guide and pin occasionally.—*Arthur R. Morgan, Naugatuck, Conn.*

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This Modern Smoking Stand Is a Refugee from a Disk Jockey

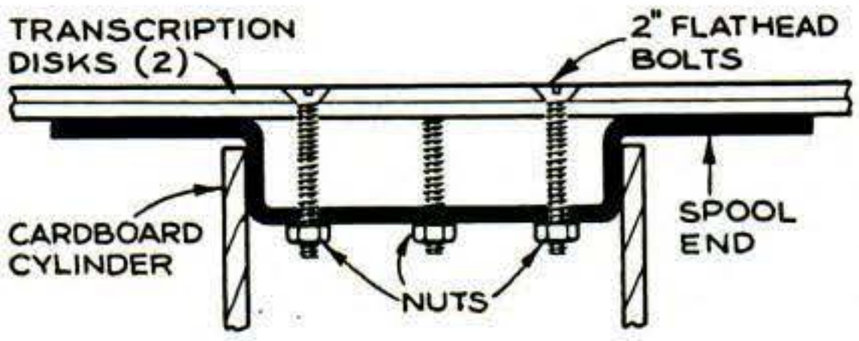
PARTS for this smoking stand are free. Its top and base are transcription disks, its upright a photostat-paper spool.

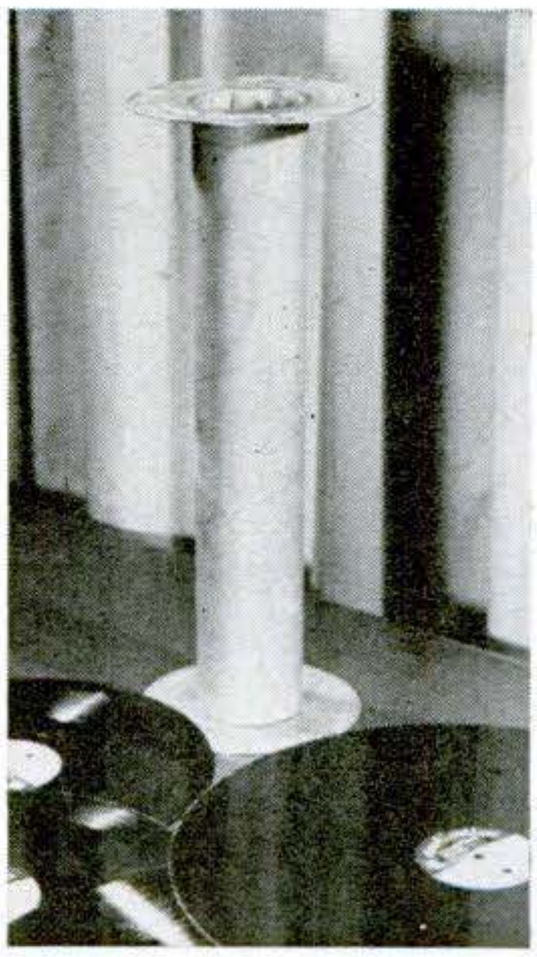
Any radio station has old transcription disks waiting to be thrown away. The king-size spool should be obtainable wherever photostats are made. Be sure to get the metal end plates with the cylinder.

Two 16″ platters are used for the top and two 12″ ones for the base. Center one on an end plate pulled out of the spool, and mark off on the plate the three holes in the disk. Do the same with the other spool end. Drill all the holes ¼″.

Countersink those in one disk of each pair to take flathead bolts. Then assemble as in the drawing. The bolt heads in the top can be painted black, or they can be covered with a disk of felt or blotting paper.

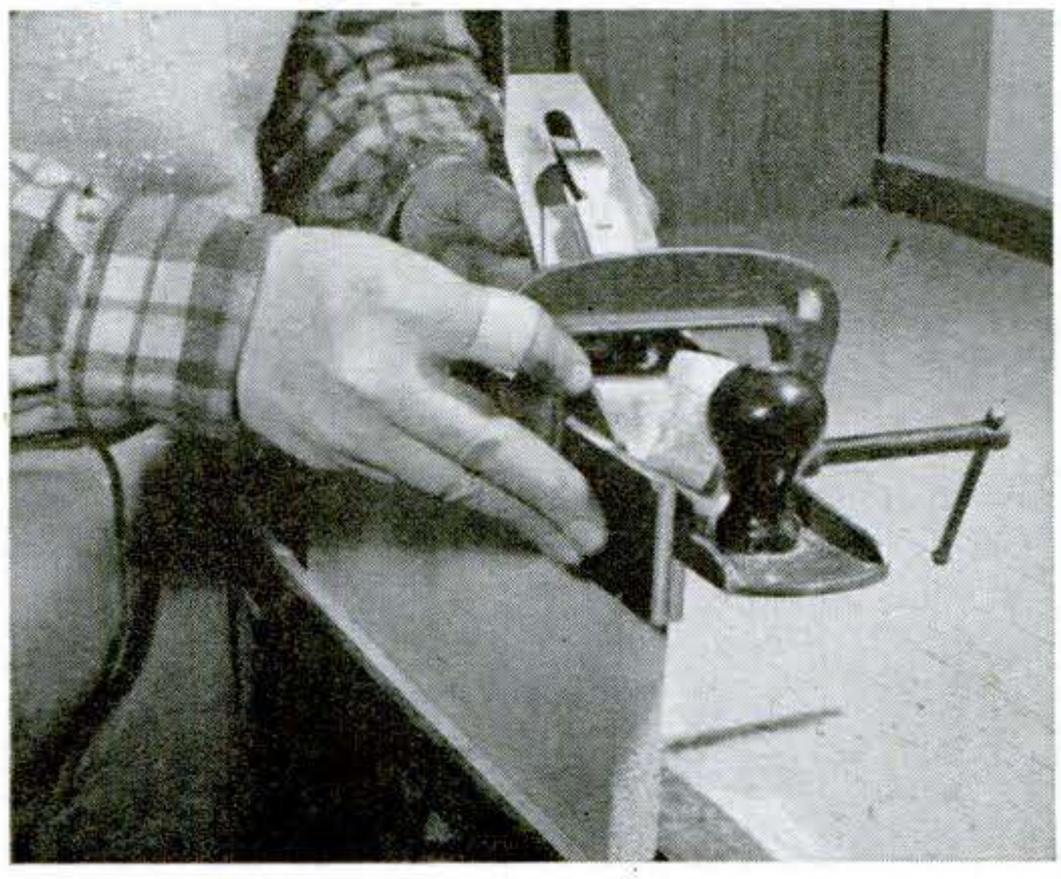
Shellac the cardboard tube before painting. The lower spool flange, which shows, can be finished to match or in a contrasting color. Push the base plate into the cylinder. Half fill this with sand and press the top into place.—*John L. Hoke, Washington, D. C.*

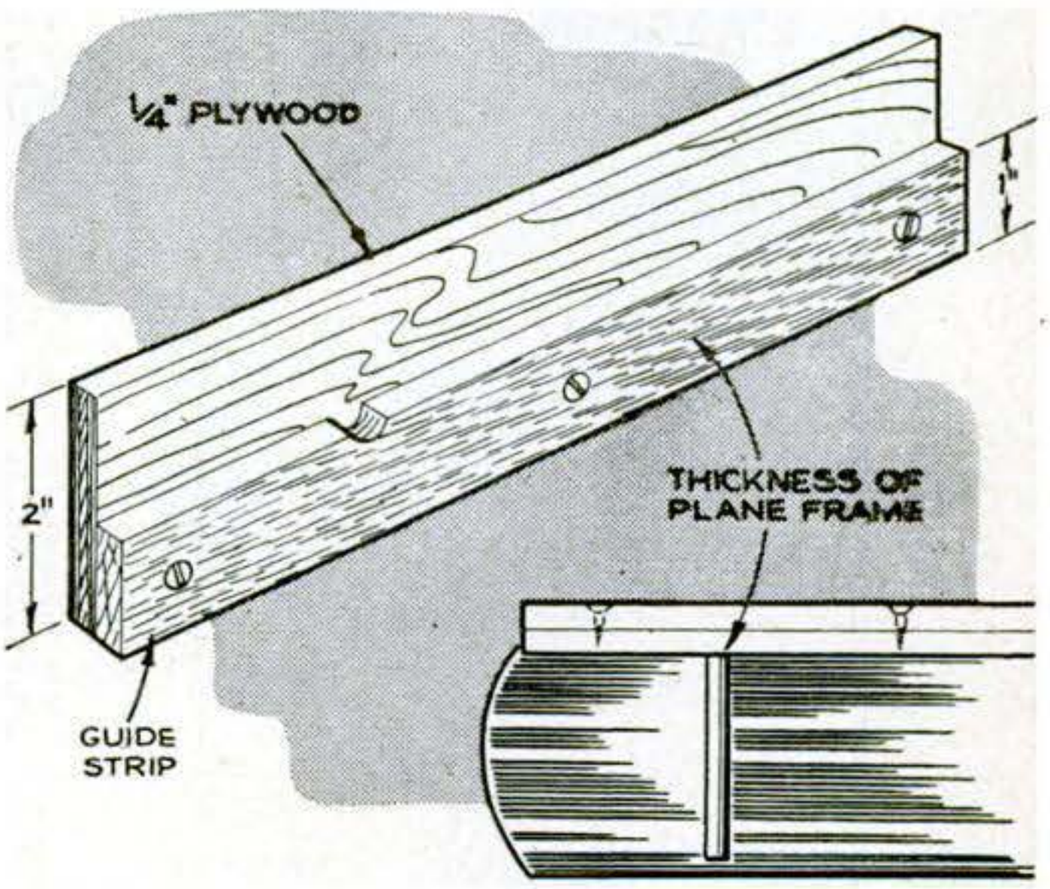




TRANSCRIPTION DISKS from a radio station form the top and bottom of this modern smoking stand. The upright is a photostat-paper spool. Sketch shows how the disks are bolted to the ends of the spool.

Right-Angle Guide Holds Hand Plane True for a Square Edge





MAKE all your edges square ones by clamping a plywood guide to your hand plane. Tack a spacer strip along the bottom of the guide so that the flat edge, not the corner of the blade, does the cutting.—*J. M. Finn, Pittstown, N. J.*

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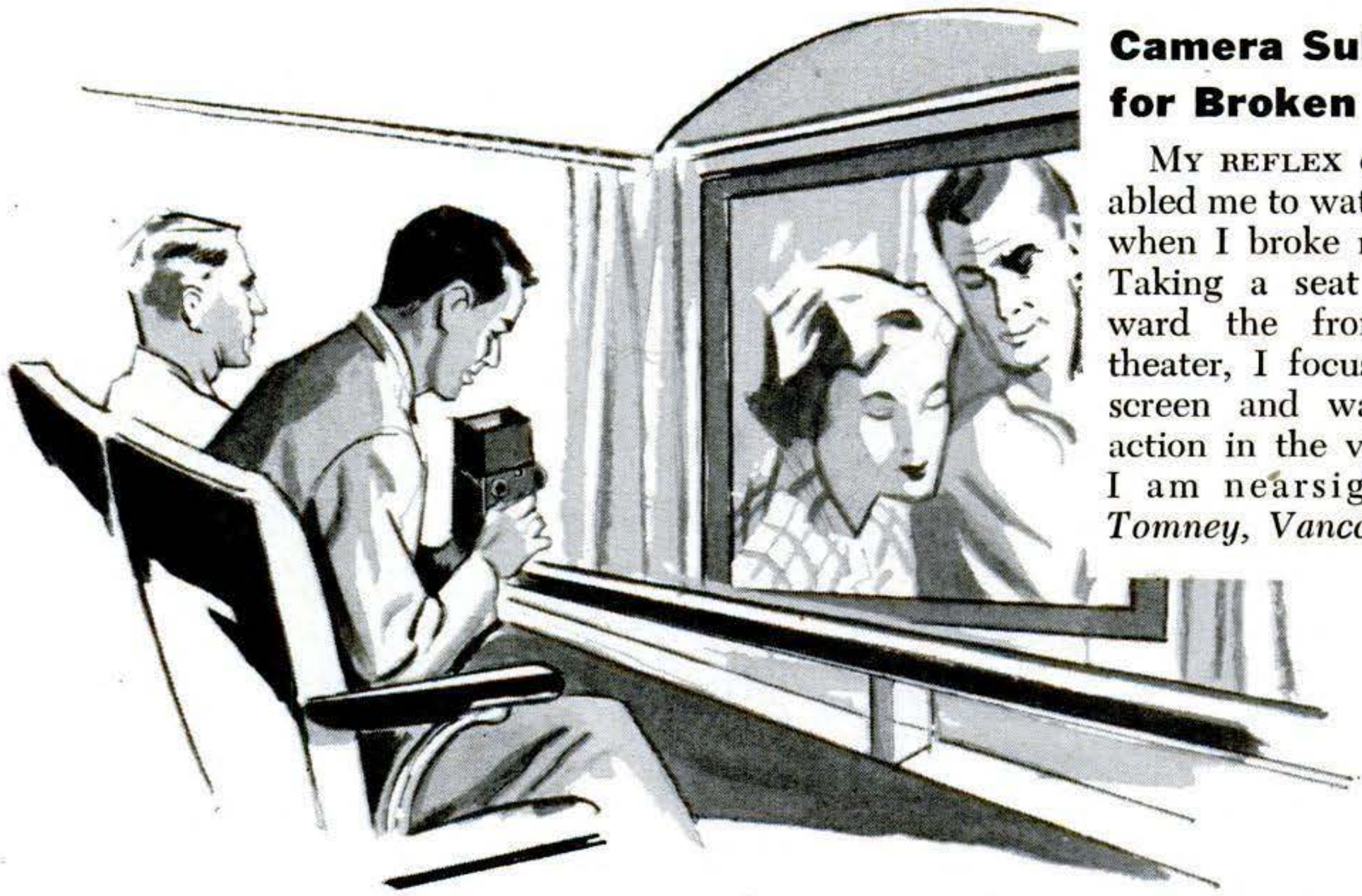


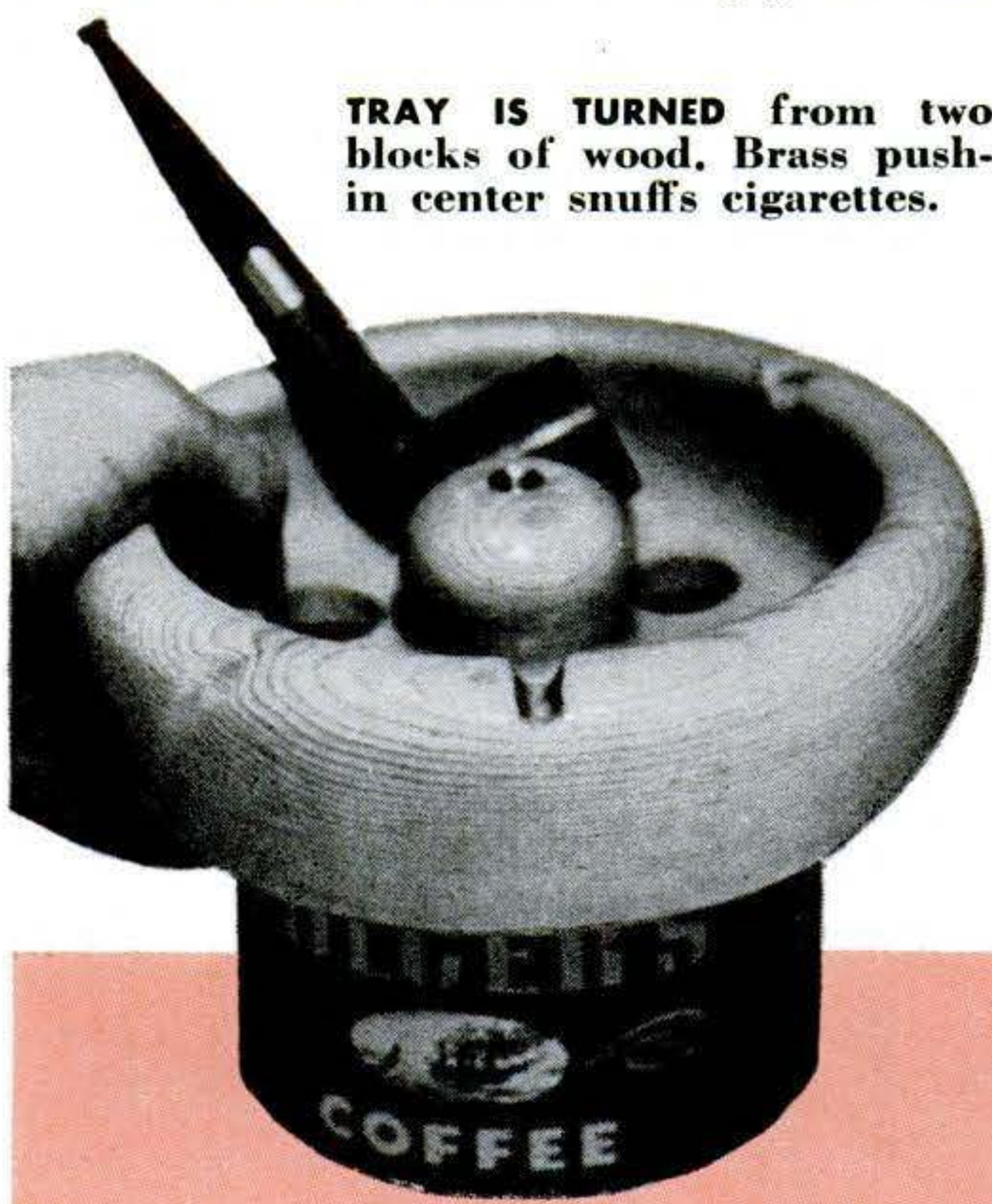
Camera Subs for Broken Specs

My reflex camera enabled me to watch a movie when I broke my glasses. Taking a seat down toward the front of the theater, I focused on the screen and watched the action in the view finder. I am nearsighted.—*F. Tomney, Vancouver, B.C.*

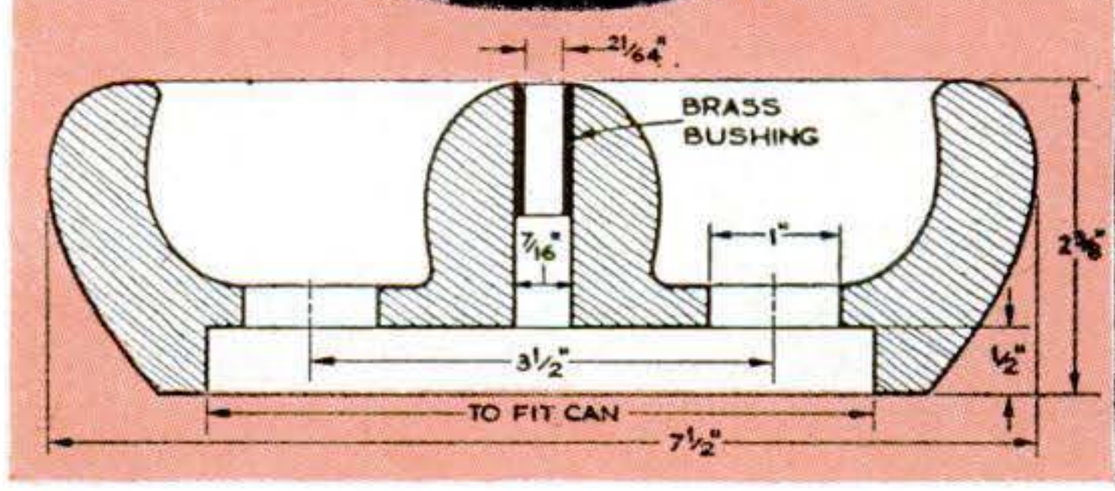
Man-Size Workshop Ash Tray Rests on a Disposable Can

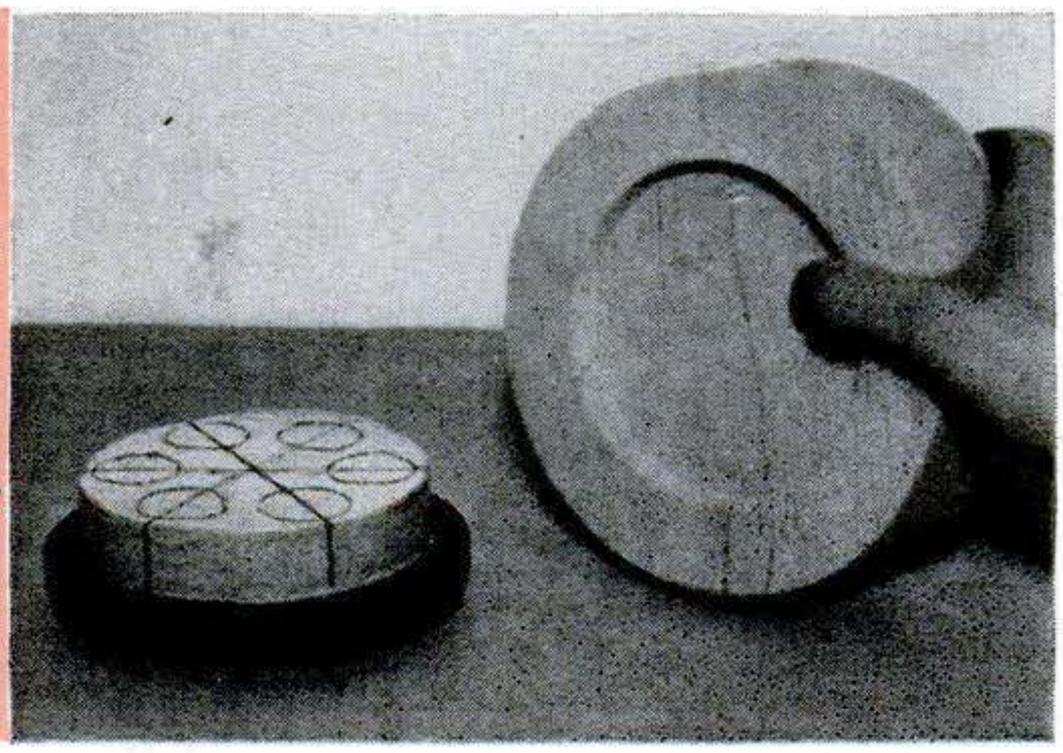
If you need a large ash tray in your shop, this one will fill the bill. It has a pipe knock and can serve as a convenient pipe holder. Water in the can will give added safety.

A piece of wood, 2½″ by 8″ by 8″ glued up or solid, is needed. The stock should be turned round and the base hollowed out to fit the lip of a can. Screw a 1″ by 6″ by 6″ piece of wood to a faceplate and turn for a snug fit with the 2½″ piece. Use your dividers to lay out six equal parts on the 1″ faceplate turning. Run the lines across and down for later reference. Draw six 1″ circles, 3½″ between centers as shown. Drop a spot of glue in each circle and clamp the two turnings together until the glue sets. Turn and drill as shown, then determine the location of the glue spots from the extended lines on the 1″ piece. The two pieces will separate after you have marked and drilled the holes with a 1″ wood bit. Next, insert the push-fit brass bushing and notch the rim for the cigarette rests.—*Vern Forsberg, Seattle.*



TRAY IS TURNED from two blocks of wood. Brass push-in center snuffs cigarettes.





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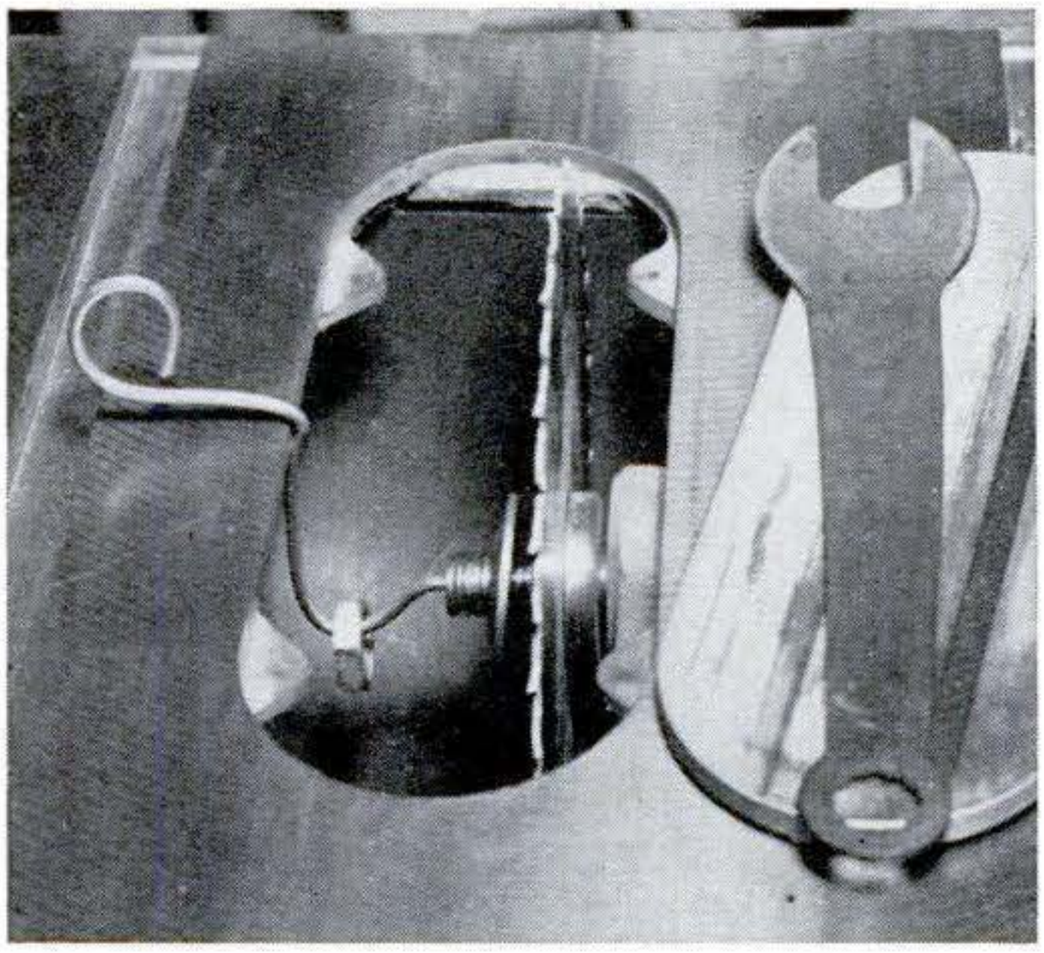
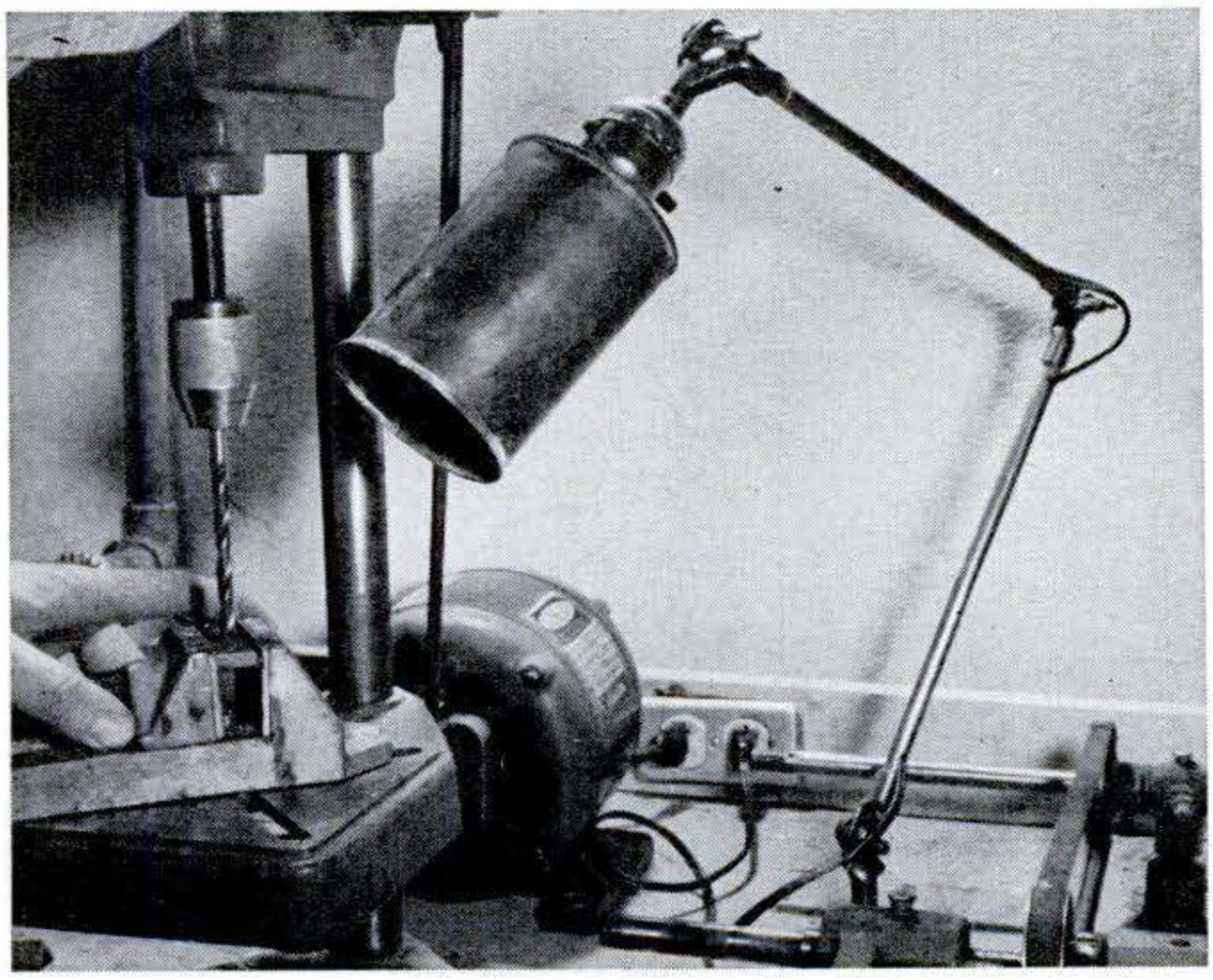


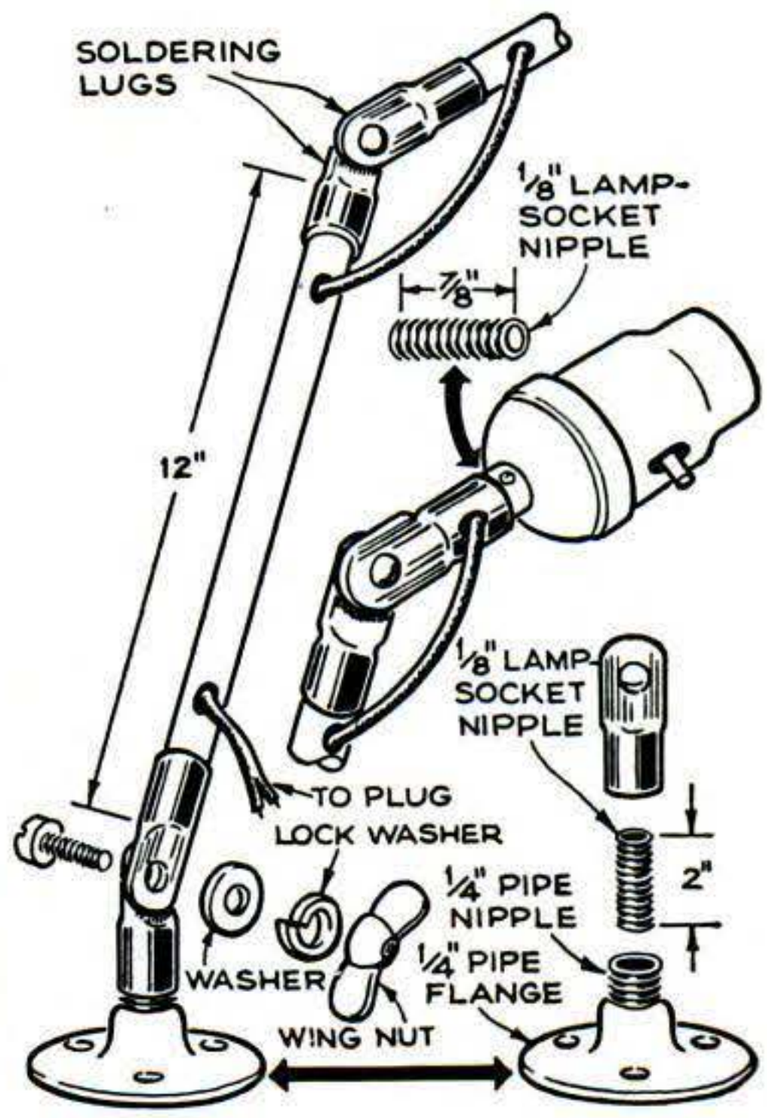
Wire Catches Saw-Arbor Nut

SAVE poking through the sawdust box for a lost nut by snapping a piece of wire against the end of the saw arbor to catch the nut when changing blades. Bend the wire so it stays in place while you loosen the nut.—*H. R. Clark, Springdale, Ark.*

Plastic Takes Place of Glass

ACETATE is the answer if you want to replace broken glass in small oval or round picture frames. This clear-plastic sheet, available in office-supply or stationery stores, can be cut with a pair of scissors.—*Arthur R. Tanner Jr., Cold Spring, N. Y.*





Tin-Can Bench Light Swivels to Any Angle on Soldering Lugs

SIX heavy-duty soldering lugs, joined by bolts and wing nuts let you angle this bench light into any position to suit the job or machine you're working on.

Buy lugs that will fit over the threaded nipples used to fit lamp sockets to bases. These nipples are threaded ⅛" pipe size and are about ⅜" outside diameter. Solder lugs on both ends of two 12" lengths of ⅜" o.d. brass tubing for the adjustable arms and solder lamp-socket nipples into the remaining two lugs. Mount a lamp socket on one nipple and sweat the end of the other nipple into a ¼" pipe nipple. Screw a ¼" pipe flange on this nipple and mount it on the bench or machine. Drill the tubing and thread lamp cord through it, leaving slack at each swivel joint.

Make a durable shade for the bulb by cutting a hole in a tin can just large enough to fit over the threads on the lamp socket.—*J. M. Finn, Pittstown, N.J.*

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[*Continued from page 130*]

in the upright exhaust stack, exploding with a belching of black smoke. It sounded not like one loose ignition wire making and breaking contact, but like two or three. Beside the tractor ran Hanratty and Blinstock, yelling varied instructions to Ezra.

"Pull out the choke, you blue-faced walrus," Hanratty screamed. "She ain't getting enough gas."

Check and Double-Check

Ezra stood up on the tractor, shaking his fist as he yelled back. Gus ducked his head under the instrument panel. He began checking the wires in front of Ezra's quivering and bony knees. A loose ammeter or ignition-switch wire, bouncing around, could be causing the missing. But why hadn't it missed, Gus asked himself, when he rode the tractor around the field? Gus couldn't find any loose wires, but just for luck he tightened the connections on the instrument panel with a deep-socketed spin driver. Then he jammed his hand down on the starter button. The motor broke into a smooth, even song.

"Now," Gus declared, straightening up to look into three pairs of cagey eyes, "what do you know about that?"

"I only know that she's hitting and I'm cutting," Ezra said excitedly. "Stand back, Gus."

It's Easy When You Know the Answer

As the old man shifted and then eased up on the clutch, the motor took hold smoothly, then missed. Gus walked along the side, peering in at the motor through the open side of the hood. Suddenly he signaled Ezra to kill it, worked on the engine a few moments with both hands, then dragged the side of the hood out from behind the tractor. He clamped it firmly in place.

He walked off down the field in a cloud of hoppers, chuckling to himself. In Mrs. Hendricks' kitchen he ate his pie and drank his cold milk.

"Don't you dare tell those boys what was really wrong, unless it happens again," he told Mrs. Hendricks with a grin. "Then you go out and show them up by fixing it yourself. It was the darndest thing I ever saw, for a fact. With one side of the hood off, those big grasshoppers were getting in there on the motor, and actually shorting out the plugs by standing on the tops of them with their forefeet, their hind kickers on the block. The shock of the juice passing through their bodies held them there. It didn't seem to cripple them a bit, either. When the motor stopped they hopped off the plugs, spry as you please. When I rode the tractor around the field I had my shoulders in the hood opening so they couldn't jump in."

Mrs. Hendricks had a happy gleam in her eye.

"Gus," she said fervently, "I'd get a store of enjoyment out of making those three look like even worse monkeys than they act—the poor dears. I surely would. Here, you'd better have another piece of pie." END

NEXT MONTH: Gus rides out a storm.

JUNIOR couldn't wait to try out the midget electric racer he had built, so while his father was playing golf, he borrowed the battery out of the family sedan. With commendable restraint he ran the racer only a few minutes. Then he replaced the battery, tightened the terminals well, and sounded the horn. A vigorous toot indicated plenty of charge left, and Junior decided to say nothing about the loan. But his father had hardly got into the car that afternoon when he promptly got out again, without even trying the starter.

"You should have told me about using the battery, son," he said. "Now it looks as if I'll be a bit late for my appointment."

...How Come?

ANSWER: *When his father turned on the ignition, he noticed the ammeter swinging to charge. Junior had put the battery in backward, and it was necessary to reverse it to prevent reverse charging and damage to the plates.*

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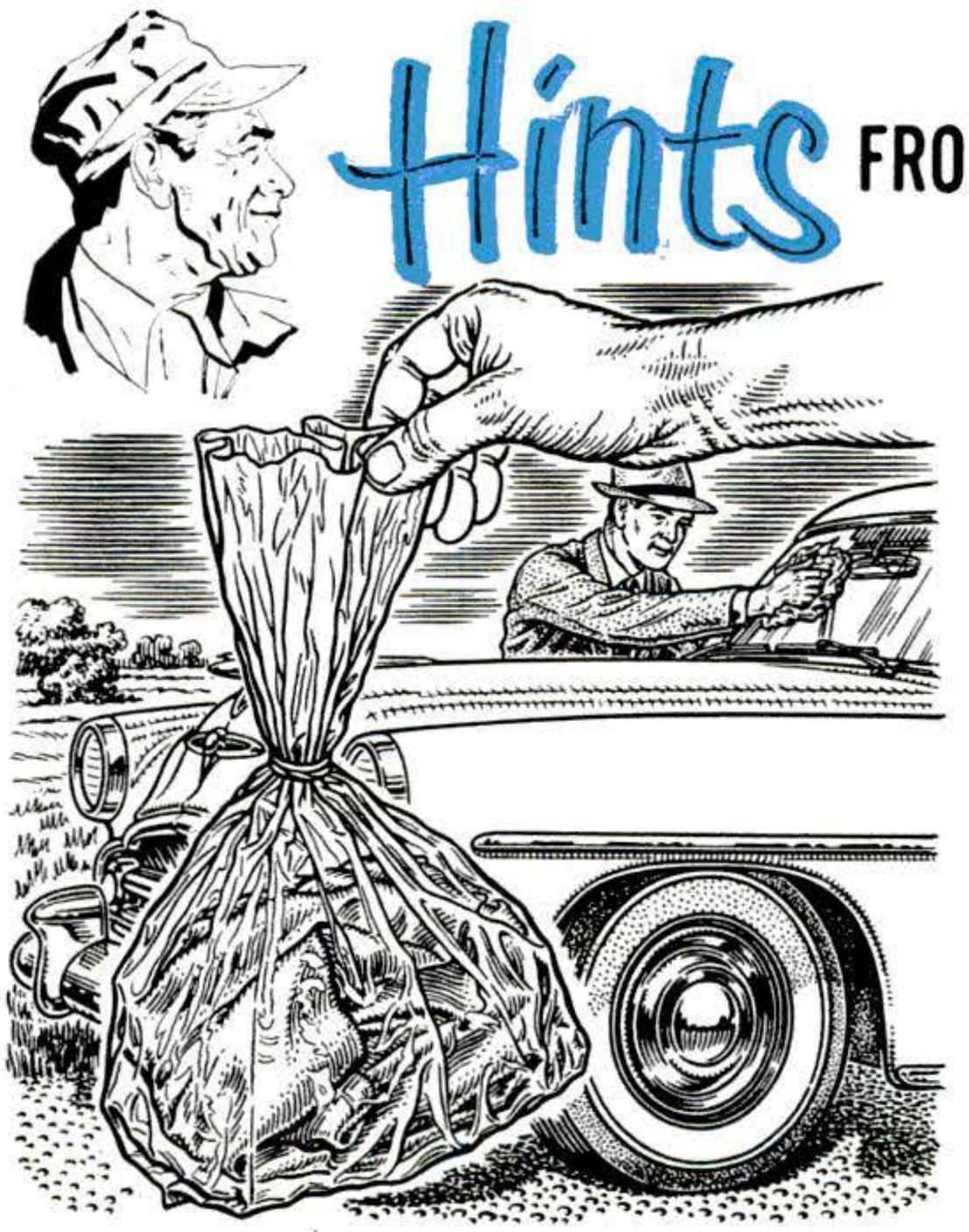
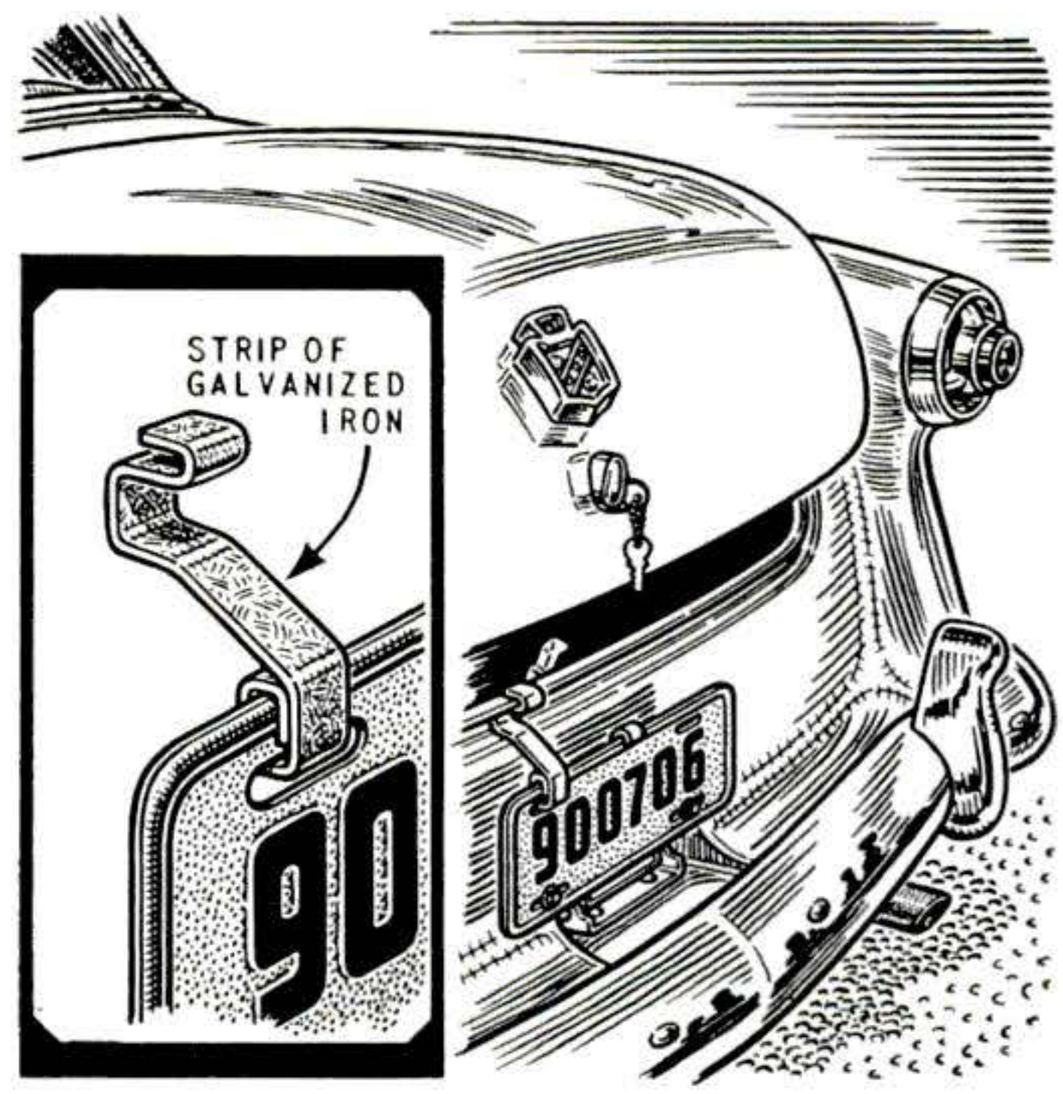
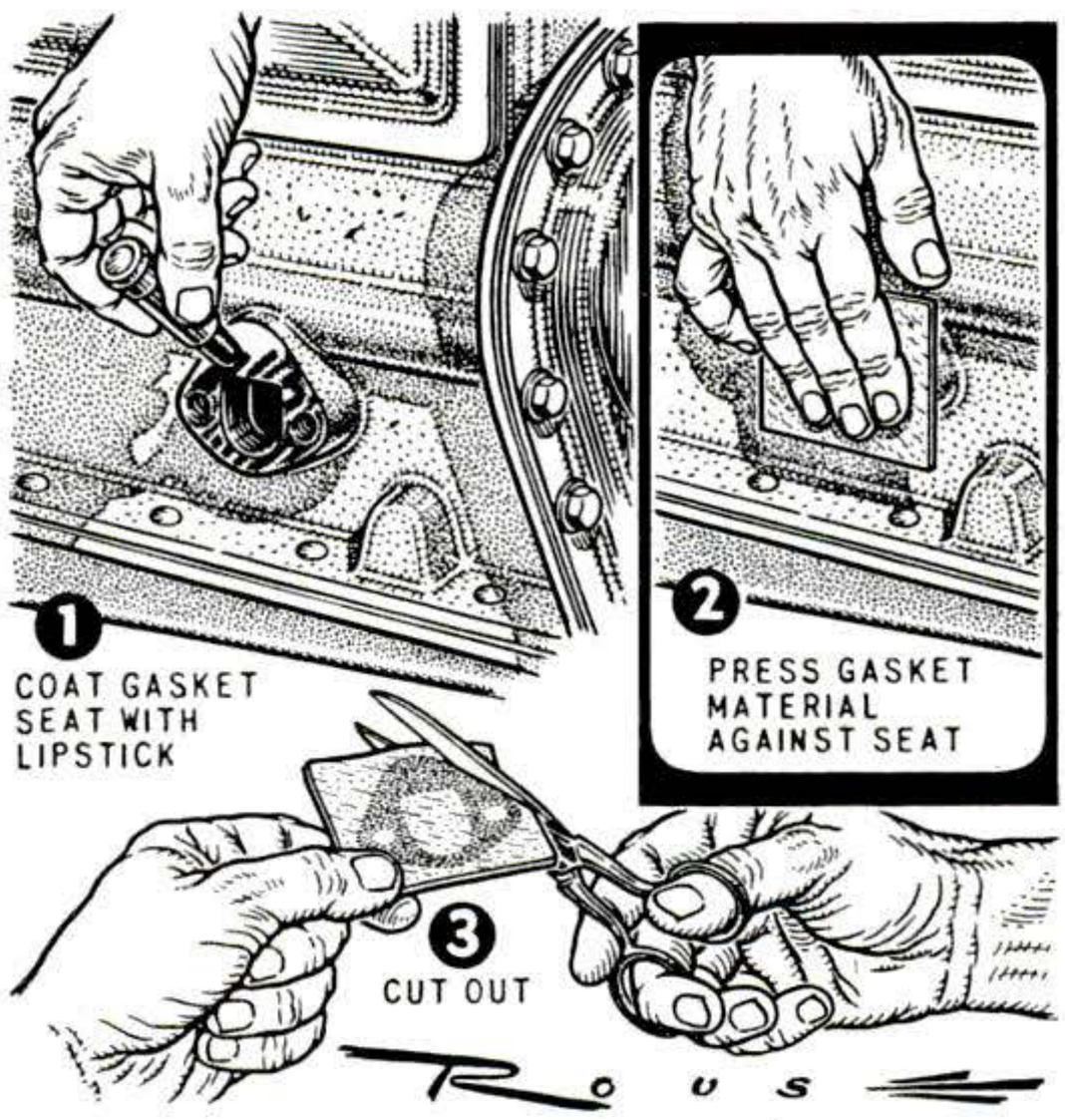
Hints FROM THE MODEL GARAGE



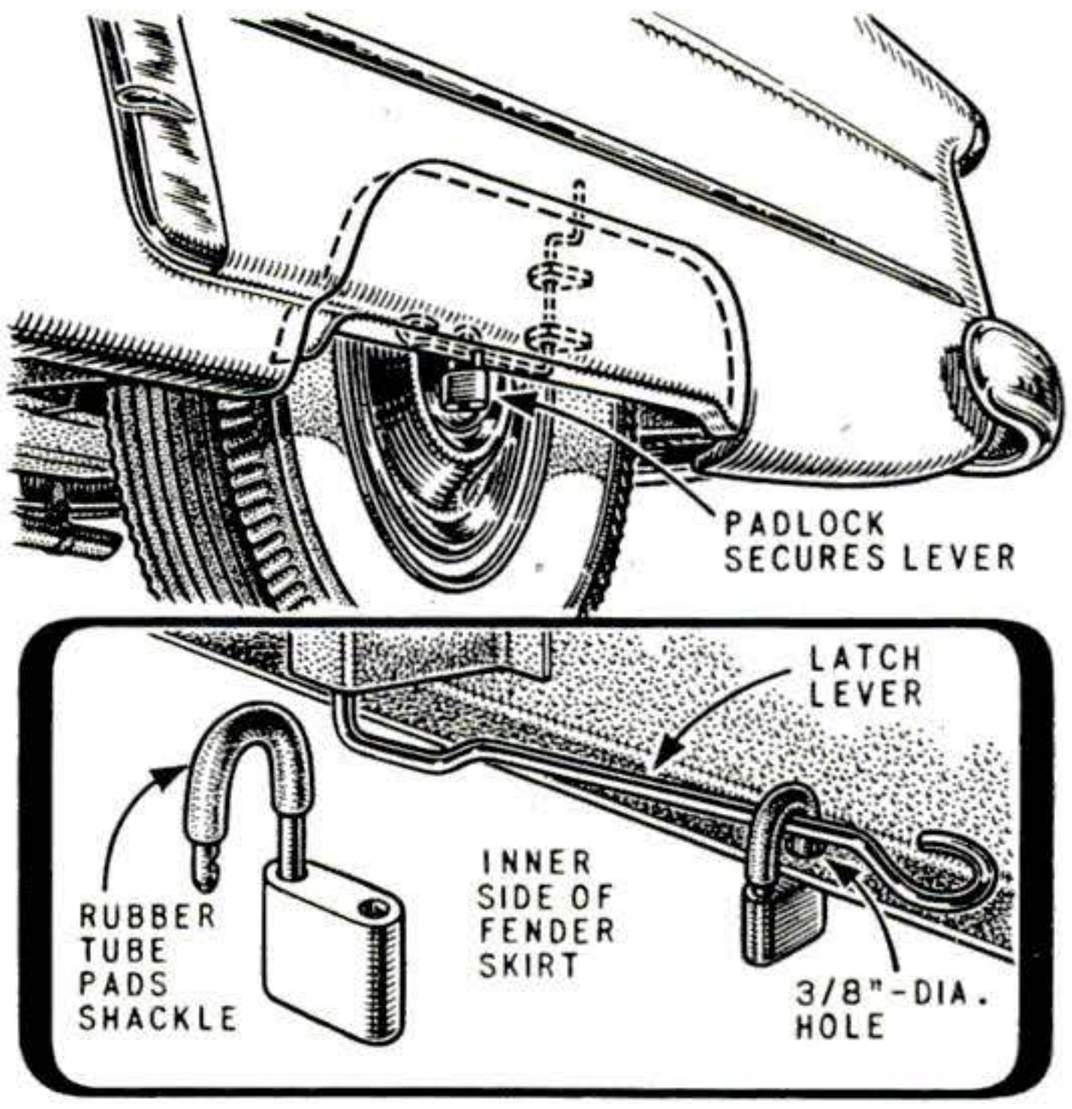
Stow a damp cloth in a plastic bag for cleaning dust and insects off your windshield between stops at service stations. Moisten the cloth with water or windshield cleaner and snap a rubber band around the neck of the bag to keep the fluid from evaporating.



To foil gas thieves, bend a length of galvanized strap iron to fit the top slot of the hinged license plate and the edge of the trunk opening. With this arrangement, a gas cap behind the license plate cannot be removed easily without unlocking the trunk.



Use lipstick to outline the shape of a flange on sheet material when cutting a gasket. Smear it over the entire surface and press the gasket material against it. The resulting imprint will show the outline as well as the hole locations.



Thieves can't remove fender skirts if you fit them with padlocks to hold the clamping levers closed. Slip a lock over the lever arm and through a hole drilled in the bottom edge of each skirt. Cover the shackle with rubber tubing to keep it from rattling.

Please turn the page for more auto hints.

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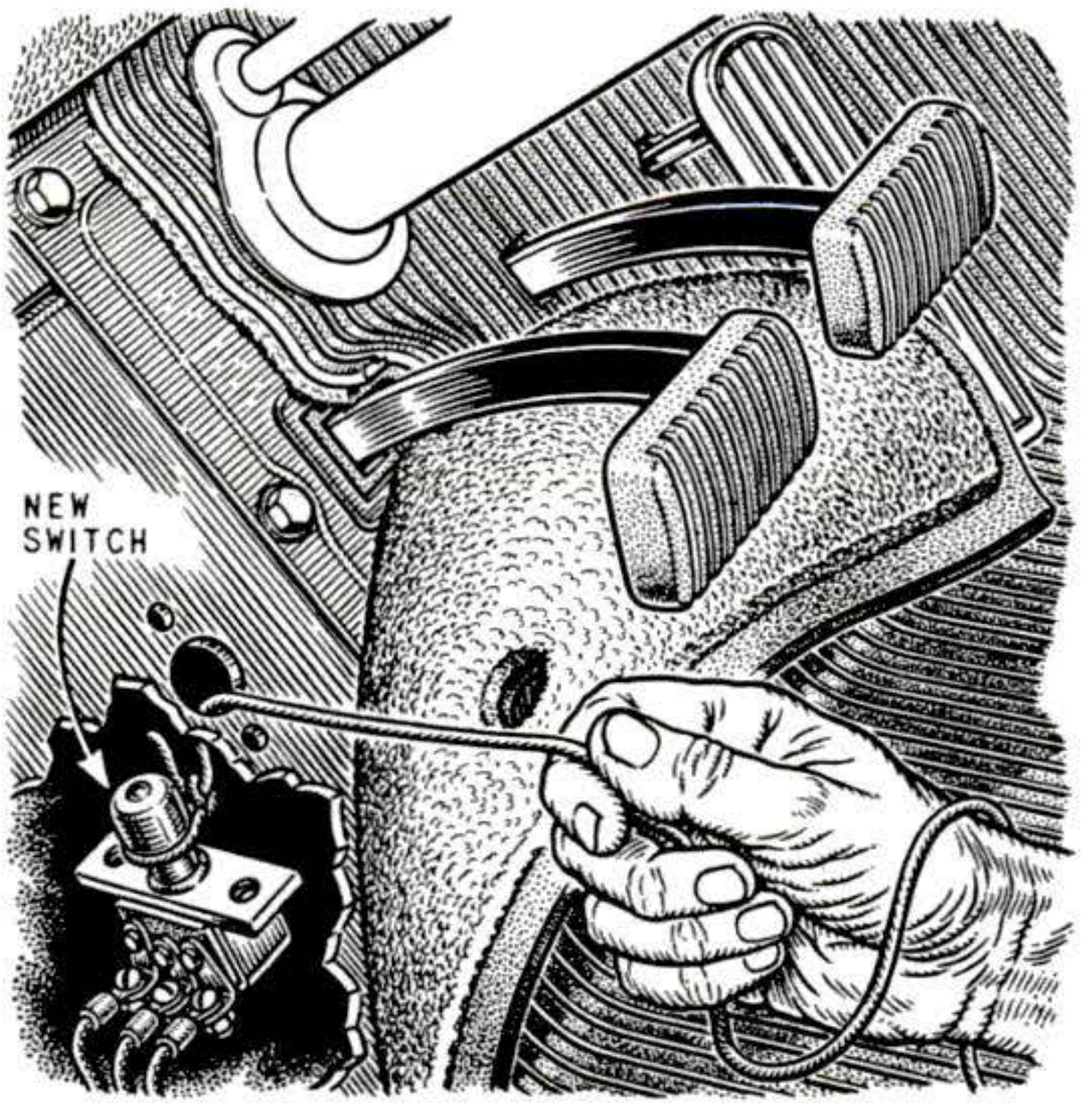
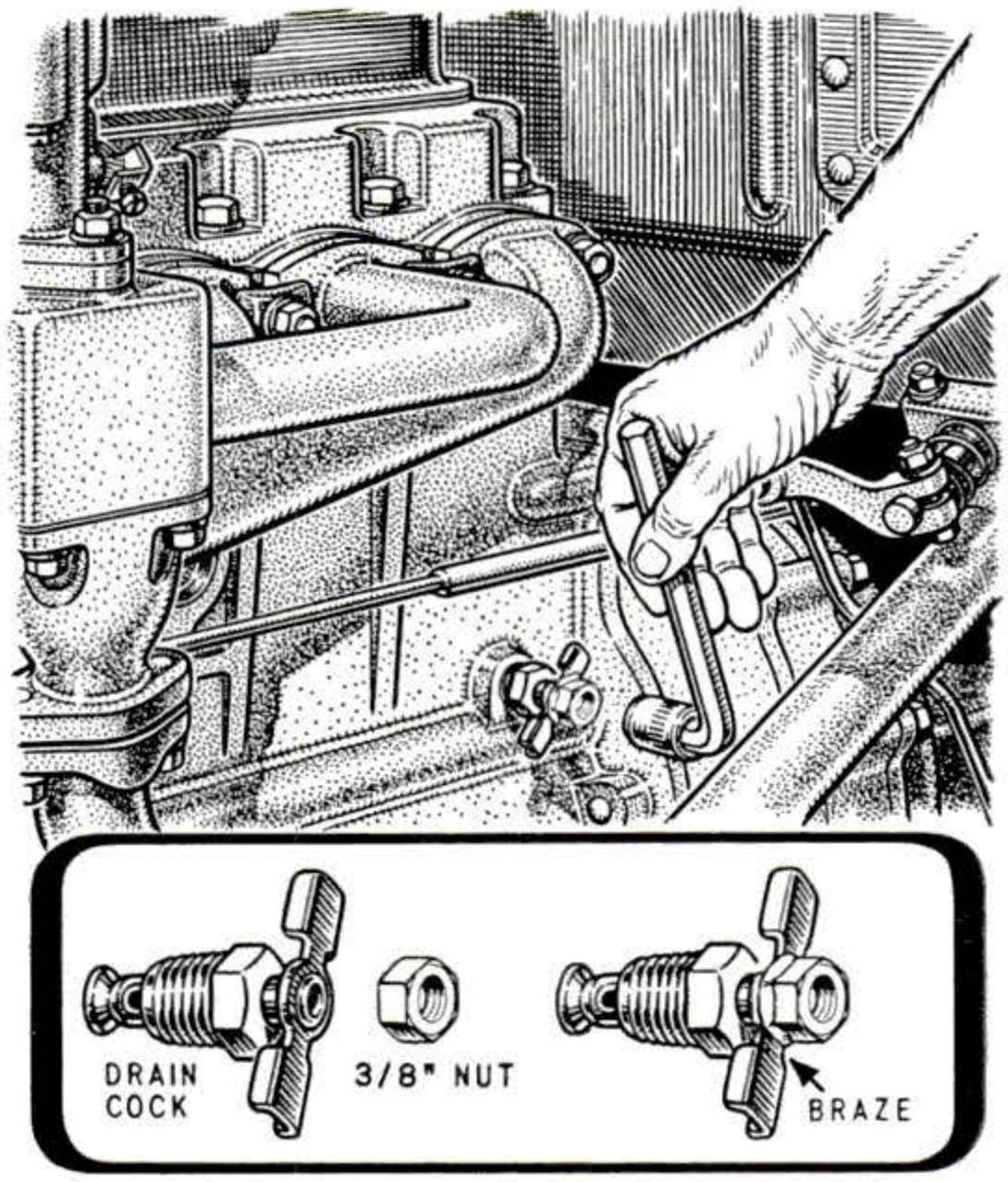
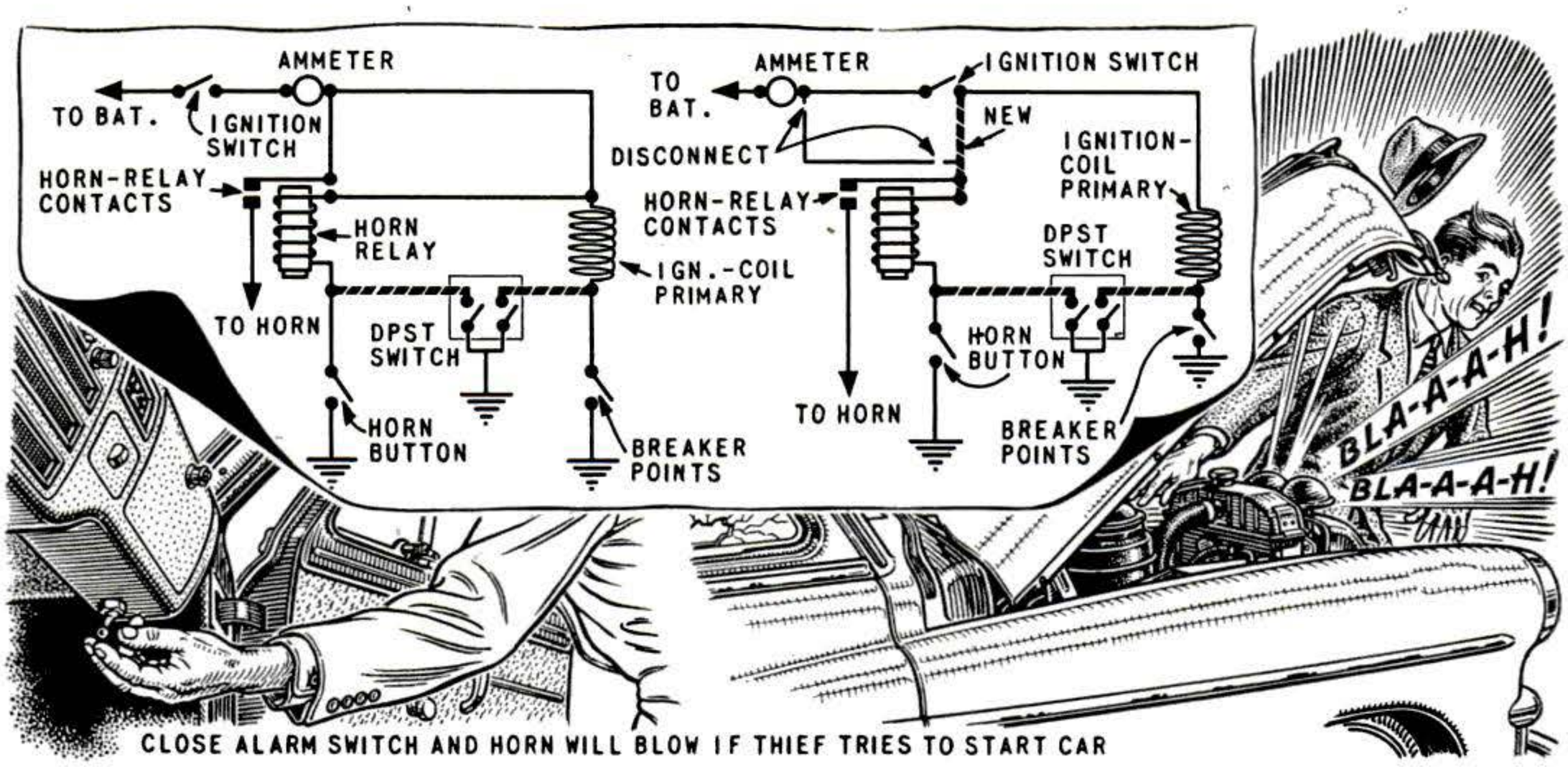
MORE Hints from the Model Garage



Tie a string to an old headlight dimmer switch before removing it to install a new one. This way you can pull the old one down by its wires and connect the wires to the new one. Tie the string on the new one and pull it up from inside the car.



Braze a 3/8" nut on the T handle of your car's drain cocks to make them easier to turn. They are usually hard to reach, too, but a 12-point socket wrench will slip over the nut easily and open the drain in the tightest spaces. Water runs through the nut.



CLOSE ALARM SWITCH AND HORN WILL BLOW IF THIEF TRIES TO START CAR

Throw a toggle switch concealed under the dash when you leave your car, and a thief's attempts to start it with a trick key or by jumping a wire to the coil will be loudly announced by a steady blast of the horn. Even if he cuts the horn wire to work in silence, he won't start the engine; the breaker points are grounded and won't spark.

The diagram at left above shows how to wire a double-pole, single-throw toggle switch on cars having the horn relay wired through the ignition switch. Heavy lines indicate the new wires. On other cars, the toggle wiring is the same, but the horn relay is disconnected from the ammeter or starter post and rewired to the ignition switch as in the diagram on the right. In either case, the horn cannot be sounded with the horn button unless the ignition switch is turned on.

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POPULAR SCIENCE MONTHLY

Mechanics and Homebuilding

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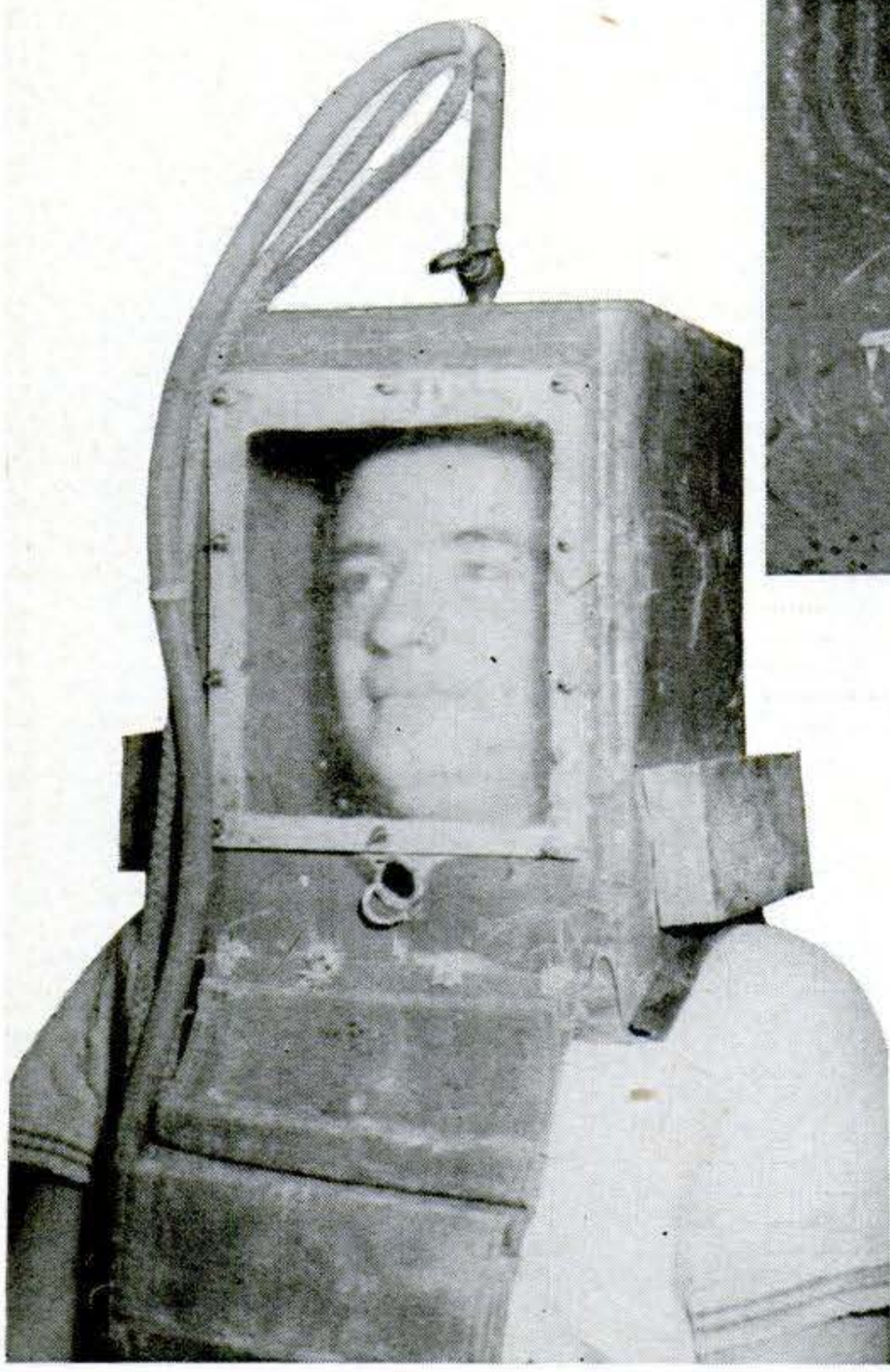
CRAFTSMEN AT WORK

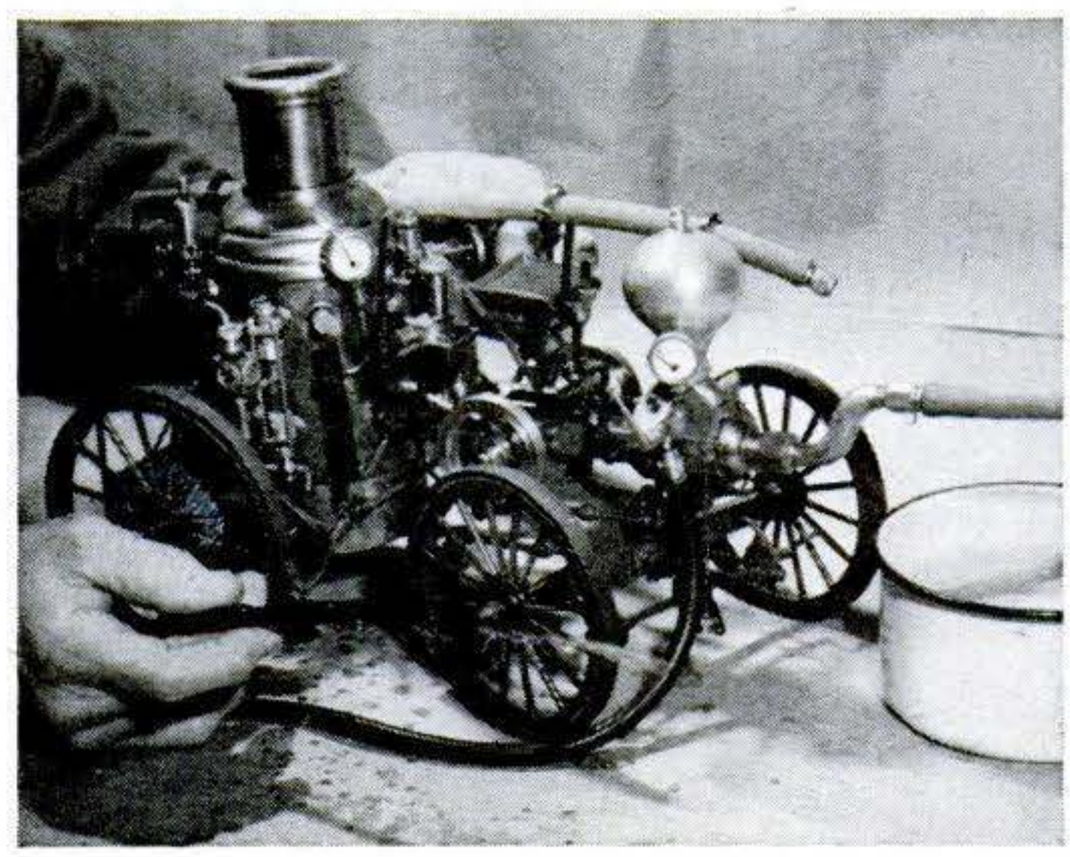
Mower Cuts Weeds Under Water. This hand-built submarine mowing machine keeps the water clear of weeds along the shore at Rainbow Springs, Fla. The sickle-bar cutter is raised and lowered by tackle and powered by a small gasoline engine.



Diving Helmet from Oilcan. A two-gallon oilcan was the starting point for a diving helmet made by Eddie Hoffmeister of Colwyn, Pa. A tire pump feeds air through welding hose and a valve in the top of the helmet. Six 10-lb. weights, held in a carrying pouch, are attached to the helmet by a long pin.

In an emergency, the pin can be quickly pulled. This drops the weighted pouch and permits the helmet to shoot to the surface, leaving the diver free.

Tiny Steamer Really Pumps. The Gay Nineties pumper below would throw a nice stream of water at a doll-house fire. All control valves and dials work, even the brakes. The entire model is brass and bronze, including wheels that are sprung at the rear. The steam cylinder has a ⅝″ stroke and ⅝″ bore; the pump, a ⅝″ stroke and ⅜″ bore. The five-tube boiler is heated by alcohol. Built by Dr. Alex Christensen of Lebanon, N.J., the steamer is an exact copy of an old-timer still in existence.



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POPULAR SCIENCE MONTHLY

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in a 1934. Some of the owners with stanch beliefs in Franklins are women, including Mrs. Marjorie M. Andrew of Lonsdale, R. I. Mrs. Andrew has a 1904, a 1929 and a 1931, all operating.

Amick works in a building-and-loan office, refers to himself as "a pencil-pusher," and bought his '05 in the first place to find something different to do outside office hours.

Even a Watchmaker Worked on It

He kept a list of everything he had to do, or had to get someone to do, as he restored the car, and that's where he discovered he had to go into 21 different trades before the job was done. Besides (1) sandblasting, (2) carpentry and (3) cabinetmaking, there were (4) auto mechanics, (5) machinist's work on the differential, transmission and elsewhere, (6) electroplating brass and nickel trim, and operating controls, (7) watchmaking—he had to get a watchmaker's help to fasten small wires to the timer, (8) plastics, to make dummy heads for the coils, (9) gunsmithing, to glue parts and make small springs, (10) upholstering—on cushions, and to make the snap-on tire cover for the spare, (11) aluminum welding—body and many parts are aluminum.

An air-cooled Franklin has no radiator, but it does have a lot of metal to clean and solder. Amick discovered that radiator repairmen (12) were the best at this of anyone, and got their aid. Repairing locks on the toolbox and on a compartment under the seat, he worked as a locksmith (13). Bouncing out bumps in his mudguards (fenders), he became a dinger (14), a trade name for the man who smooths out dents and bumps.

He became a leather worker (15) as he went over the seats 100 times with neat's-foot oil and saddle soap to soften them and make them like new. He supervised 18 to 20 coats of paint (16). He polished one thousand brass openings in the grille (17). Rewiring the car, he became a general auto electrician (18). In the process, he was able to buy some cable identical with that installed in the original 1905 Franklins. He got it from the same company that made it then.

Car Was Hauled from Elmira, N.Y.

He had to be a typist (19) to write the dozens of letters that were necessary to locate the car in the first place. Once he had the car, he became a trucker or transporter of heavy stuff (20). He had to move it by tractor-trailer and truck from Elmira, N. Y., to Maryland.

"Finding the right man to do a job," he says, "was often the biggest problem." Despite the help he obtained, Amick estimates that he did over three-quarters of the work himself.

Finding the right parts, in junk yards, auto-parts shops, or wherever, was also a problem. To do it, Amick got into photography (21). To show parts dealers and others exactly what he required, Amick took pictures of his old, beat-up parts—a hub cap and lamps, for instance—and circulated the photos. Eventually, he got everything he needed.

Of the photograph showing the unrestored car (page 93), Amick says today, "Unfortunately, the picture flatters it." Of his restoration job as a whole, he says, "Everywhere you looked you had problems. But I've seen a lot worse reconstruction jobs. One man rebuilt a car, for instance, by picking up parts that had been lying out in a field for 20 years."

Amick's enthusiasm for restorations, and for air-cooled cars, has not been lessened by his difficulties. He has just purchased, and is starting to restore, another Franklin—this time a 1912 Torpedo Phaeton. END

She's Defended

Woman to husband: "I scratched the front fender a little, dear. If you want to look at it, it's in the back seat."—*L & N Magazine.*

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New life for your engine

WINGED performance for your car

There is an AC Spark Plug engineered to General Motors standards for *your* car. These famous Spark Plugs bring you the power-boosting, gas-saving advantages of AC self-cleaning patented insulation.

HEART of your car's performance

Every gallon of gasoline you use must be fed steadily, dependably, efficiently to your engine's carburetor. If your fuel pump is several seasons old it is wise to replace with a new AC Fuel Pump.

Keep your engine full of life — smooth and responsive, powerful and economical! Have your oil filter changed regularly, every 4,000 to 6,000 miles, and be sure you get a genuine AC Oil Filter each time you make this important change.

Briefly — here are some of the benefits you get when you protect your engine with an AC Oil Filter. The clean oil you buy is *kept clean*. Every tiny particle of dirt, grit, metal is filtered out — *trapped* so it cannot injure the close-fitting parts that make a modern engine efficient and quiet. Full, clean-oil lubrication is furnished *all* the time, not just when oil is freshly changed. Have a new AC Oil Filter installed at factory-recommended intervals.

125,000 DEALERS TO SERVE YOU

AC SPARK PLUG DIVISION GM GENERAL MOTORS CORPORATION

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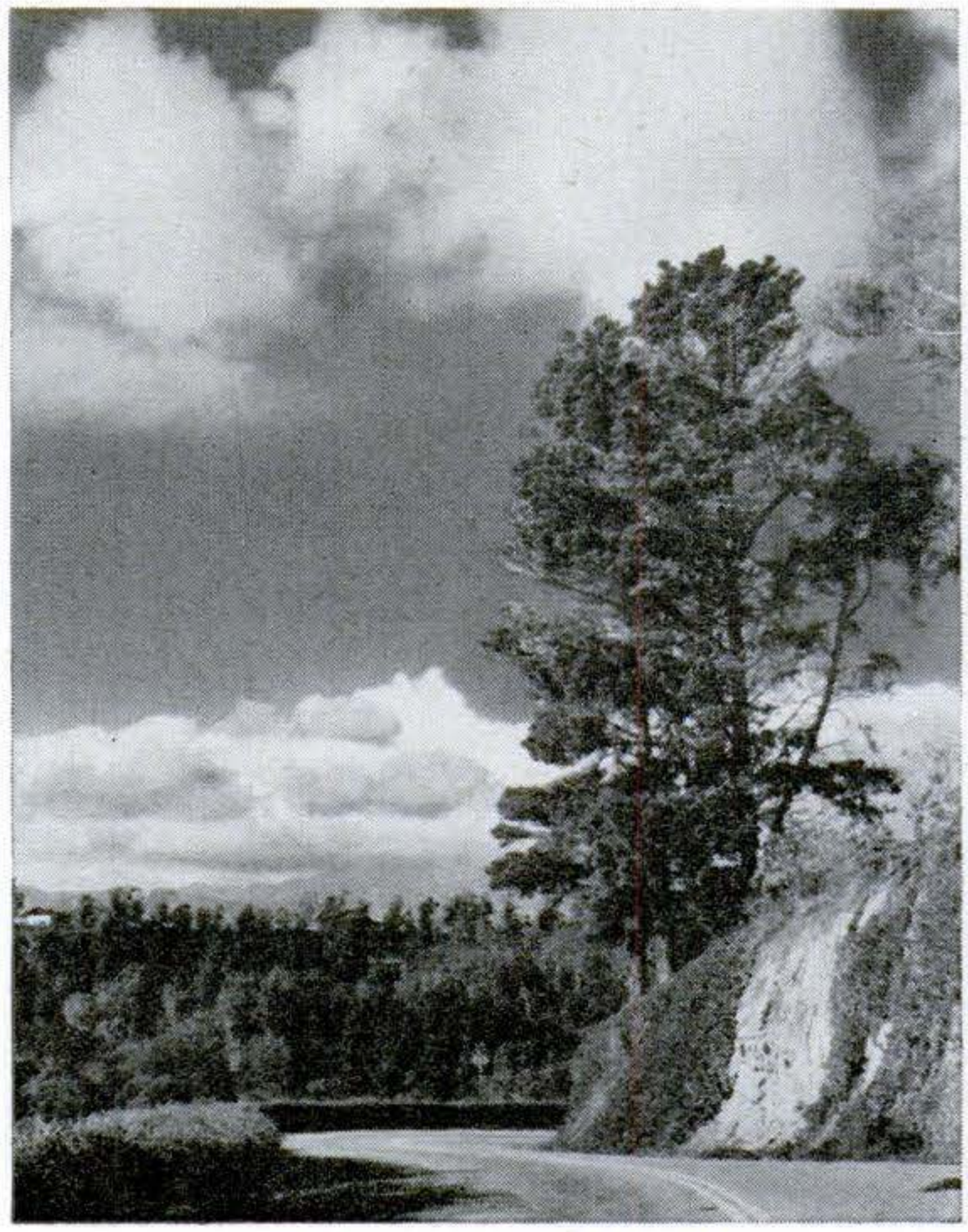
Normal photograph



Taken with red (A) filter

How Kodak Wratten Filters give your snapshots true-to-life sparkle

Designed to assure "high-fidelity" results, they are the world's standard for photographers, engineers, and scientists

THE HIGH FIDELITY you read about in musical reproduction is arrived at by electronic filters. In somewhat the same way, photographic filters assure true-to-life realism and sparkle in your snapshots.

They act upon the colors of a scene in such a way that, in a black-and-white snapshot, these colors assume the relative brightnesses seen by the human eye. In this way, white clouds are made to stand out in fleecy grandeur. Green foliage becomes sharply real and well defined. Close-ups of human subjects are thrillingly lifelike.

This "high fidelity" given to your snapshots by Kodak Wratten Filters is one of the most enjoyable discoveries you can make in photography.

For nearly half a century Kodak Wratten Filters have been the world's standard of accuracy and precision not only in photography but in many other areas of science and engineering. Such universal acceptance is due to the way these filters are made. (See picture story on next page.)

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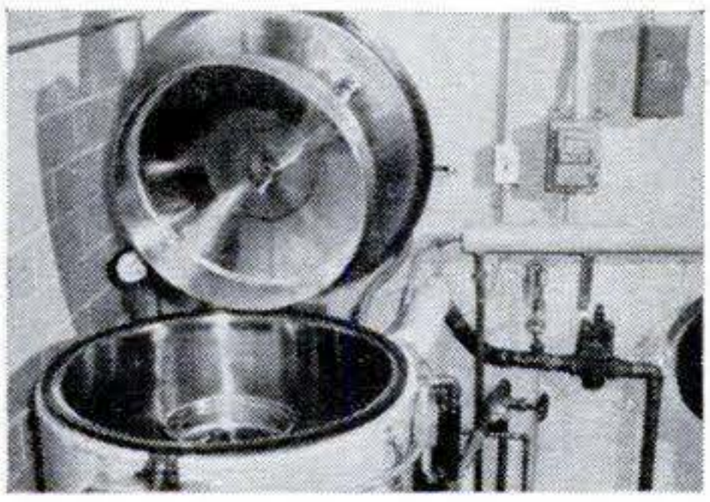
How Kodak Wratten Filters are made

Highest quality dyes. Kodak uses hundreds of different filter dyes, specially selected for purity and brightness, and carefully blended for precise color quality required for each filter.

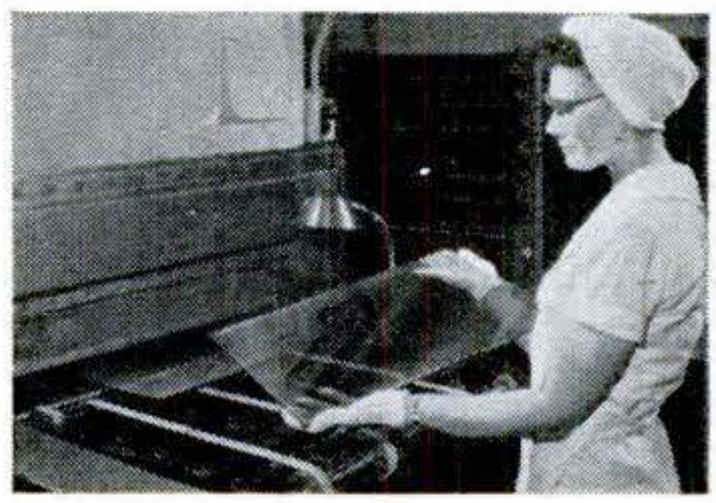
Meticulously filtered. After the dyes are blended according to strict formula, they are filtered and refiltered to obtain the optical quality specified by the Kodak Research Laboratories.

Dyes are color-matched. Each dye solution must match a color standard. A special instrument—a spectrophotometer of unusual design—controls the color of the filters.

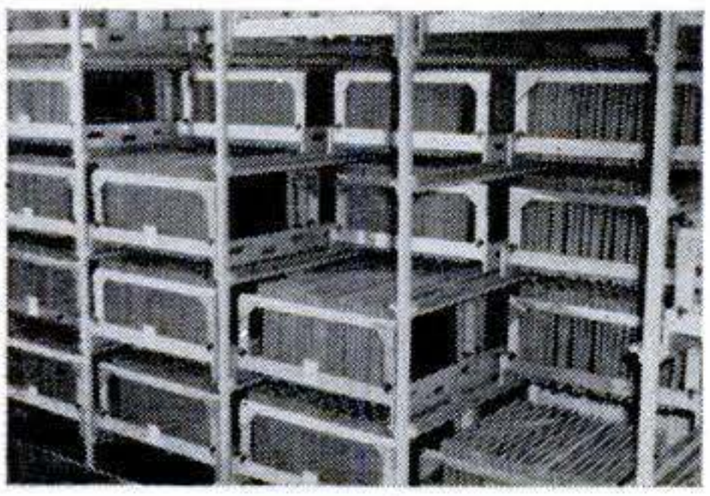


Gelatin is "clarified." In this machine specially selected, color-free gelatin is given high clarity by centrifuging it under vacuum to remove possible foreign particles.

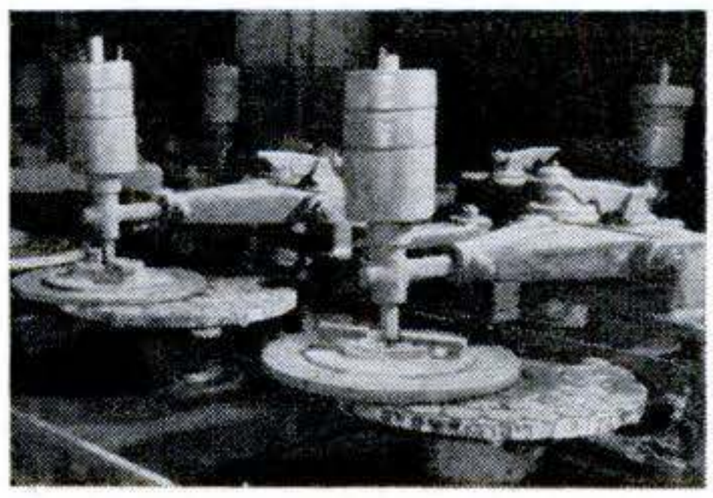
Dyes mixed with gelatin. The carefully standardized dye solutions are accurately metered into the liquid gelatin. The resulting crystal-clear mixture is again filtered.



Coating on glass. The dyed gelatin solution is uniformly coated on ground and polished glass sheets and then dried. Here coated sheets are being removed from the dryer.



Conditioned for two weeks. The dried gelatin coating is removed from the glass and conditioned for two weeks in special racks. It is then inspected for color and physical quality.



Glass cut, polished like fine lens. For protection and ease in handling, Wratten Filters are mounted between ground and polished glass. Unmounted filters for laboratory use are lacquered.

Cemented for permanence. A continuous layer of cement permanently bonds filter, glass and metal protecting ring into a single unit—like your camera lens.

Prices of Kodak Wratten Filters start as low as 50 cents unmounted, $1.75 mounted. Consult your dealer for details. Ask for informative filter booklet.

Eastman Kodak Company
Rochester 4, N. Y.

Kodak
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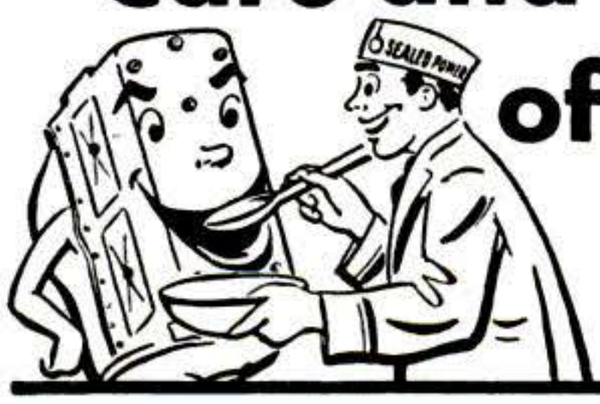
Care and Feeding of Engines



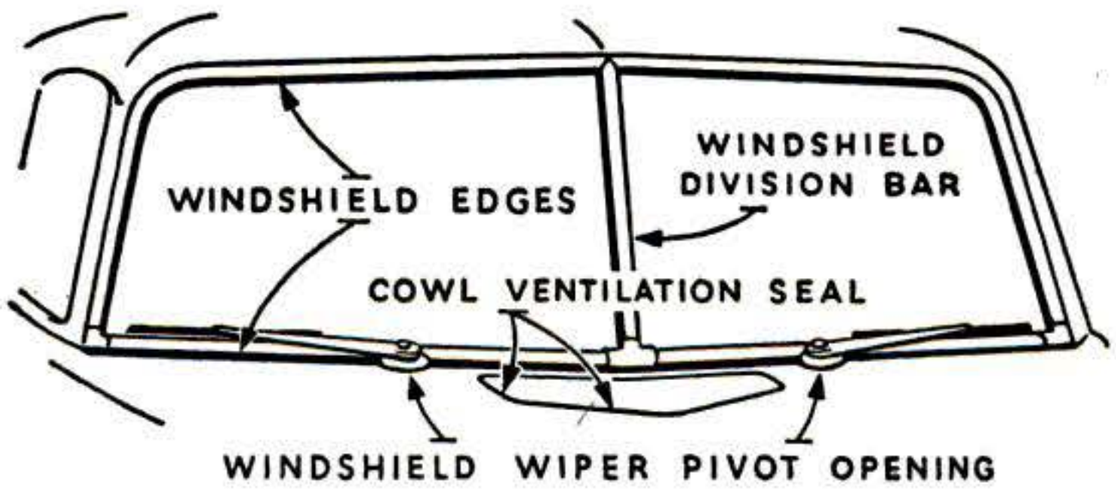
BY
S. P. CORP

WINDSHIELD WATER LEAKS

If heavy rain leaks in around your windshield, it means that the edges of the windshield need to be resealed in the following manner:

WINDSHIELD SEALING

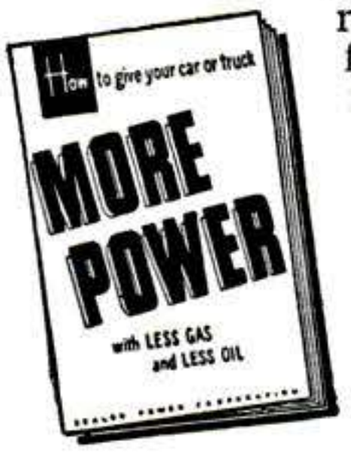
Remove center division bar by taking screws out from inside. If leaks occur at center of instrument panel, center bar may not have been tightened correctly. Loosen, but do not remove, garnish molding around inside of windshield. Remove windshield wiper arms and stainless steel molding from the outside of the windshield, using care in working it away from glass.



Now seal weatherstrip against the body opening by lifting the rubber and applying a good grade of windshield sealer. Use a nozzle-type applicator so as to force the sealing compound up and around the body edge where the rubber fits up over the edge. It is not required to seal between glass and rubber unless glass has been replaced. In such a case, remove inside garnish molding and apply sealer between glass and weatherstrip. Seal the windshield all along the bottom and for a short distance up the sides. Wipe off excess sealer and replace moldings, drawing them up so the rubber is slightly compressed. Use a cleaning fluid to remove excess sealing compound.

FREE HELP ON CAR CARE

When it's time to re-ring your engine, be sure to use a Sealed Power KromeX Ring Set, with solid chrome faces on top compression ring and rails of steel oil ring. These rings are factory seated for fast break-in and immediate oil control, and their chrome faces fight heat, friction, abrasion and corrosion—the enemies of ring life. For your free copy of the illustrated manual, "MORE POWER, Less Gas, Less Oil," simply address a postal card to Dept. H-7, Sealed Power, Muskegon, Michigan.



Sealed Power
PISTON RINGS

Horizontal Hotels

[*Continued from page 115*]

You like being able to park your car at the front door, within view and easy reach. You are comforted by the fact that the fire hazard is reduced in your ground-floor lodgings. You are relieved that you are not expected to tip.

Operators Provide "New Look"

Most motel operators, 94 percent of whom own their own places, have done their best to remedy the conditions that you have sometimes found and always beefed about: lukewarm water, limp water pressure, poor lighting, inadequately soundproofed rooms, narrow beds, cheap furniture, too few mirrors, tiny bathrooms.

On the other hand, they have endeavored to provide what pleases you most in a motel: rooms of various sizes so that you can pick one suited to the size of your party, twin double beds, radiant heating, year-round air conditioning, circulating ice water, an ice-cube machine, a television set, a telephone, more than one easy chair, and a drying rack in the roomy bath.

You also relish the thoughtful, friendly type of treatment from your host that was recently displayed by a motel manager in Indiana. A party of Chicago hunters homeward bound from a week's hunting in northern Michigan rolled into his driveway late one night. They were more than eager to climb into his comfortable beds, but were nervous about leaving their week's bag of game in and on the car. The motel owner quickly soothed their fears. By the time he had them settled in his cozy rooms, he had their game tucked away in the roomy freezer locker of the drugstore across the street. END

Sound Comment

Ed: "The horn on your car must be broken."
Fred: "No, it's not broken—it's just indifferent."
Ed: "Indifferent? What do you mean?"
Fred: "It just doesn't give a hoot."—*Wireco Life.*

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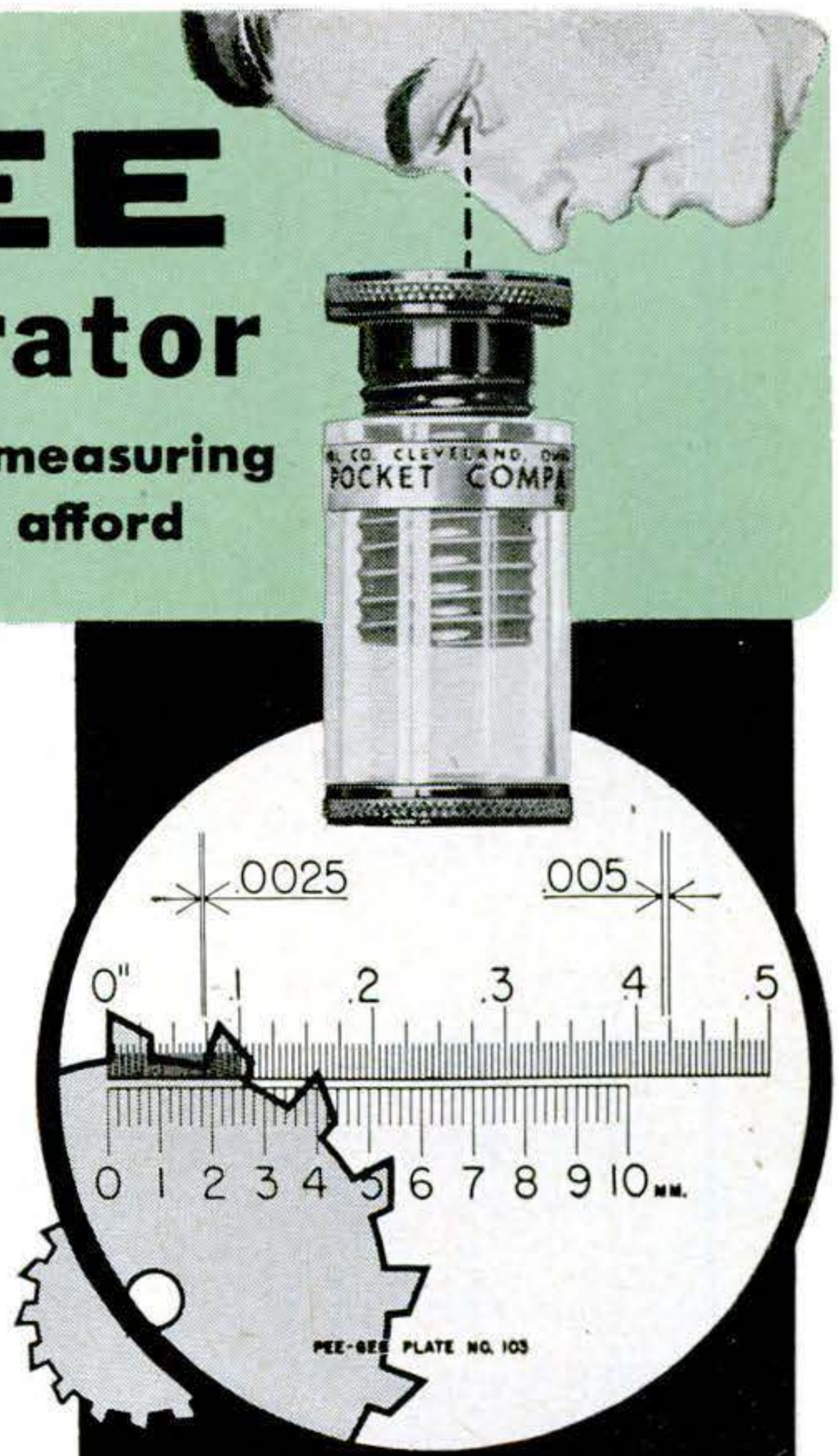
THE

PEE-GEE

Pocket Comparator

Sensational new precision optical measuring instrument every mechanic can afford



The "Pee Gee" Pocket Comparator comes with the "Scales" reticle, number 103, and instruction booklet in a dust-tight plastic container.

$9.75 POSTPAID

The "Pee Gee" Pocket Comparator is a precision optical instrument for determining extremely small dimensions. It has almost unbelievable accuracy through the use of a powerful magnifying lens (approximately 6 power) and tiny transparent patterns called "reticles" which are actually extreme reductions of large precise "Master" layouts. The "Scales" reticle, which comes in the instrument, is used to measure dimensions from .0025 to .5000 of an inch in steps of .0025, and 0 to 10 MM in steps of .2 MM.

Other reticles for measuring radii, angles, threads, thicknesses, diameters and fractional dimensions are available for the instrument. Reticles can be furnished with black or white etchings at option of purchaser. The adjustable lens barrel and reticle retainer ring are of machined aluminum with a black anodized protective finish.

This instrument is extremely valuable to printers and artists . . . and to those whose hobby is building scale models, collecting stamps, making costume jewelry, engraving or etching. It can also be used for a wide variety of small-dimension measuring operations in the home workshop, and is widely used in industry for precise inspection operations.

SEND FOR DESCRIPTIVE FOLDER

Six extra reticles for measuring:

RADII . . . from 1/16" to 3/8" in steps of 1/32" (Reticle #102).

ANGLES...from 0° to 90° with 5° increments (Reticle #104).

THREADS . . . scales for 8, 14 16, 18, 20, 24, 28, 32 and 50 threads per inch (Reticle #105).

THICKNESS . . . from .002 to .016 in steps of .001 (Reticle #108).

DIAMETERS . . . circle scales for .005, .010, .020, .030, .040, .050, .100, and 1/64" to 1/16" in steps of 1/64" (Reticle #109).

DIMENSIONS . . . linear measurements from 0 to 1/2" in steps of 1/64" (Reticle #116).

In convenient permanent case. **$4.25 postpaid.**

Inquiries from Interested Dealers Welcomed

☐ Send me Free Descriptive Folder.

☐ Send me a "Pee Gee" Pocket Comparator containing the "Scales" reticle. (Please enclose check or money order for $9.75).

☐ **Send me a "Pee Gee" Pocket Comparator and the convenient case containing six extra reticles. (Please enclose check or money order for $14.00).**

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You get this saving *plus* convenience and service. Our 3 million members (more than any other company insures) pay for their insurance semi-annually. They are served — in case of accident — by our own 7000 agents and 700 claim expediters.

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Ask your agent for your new State Farm insignia (like above) in bright red headlight-reflecting Scotchlite. Display it proudly on left rear car bumper to identify yourself as "careful driver, soundly insured"... to provide emergency reflection when parked or if taillight fails.

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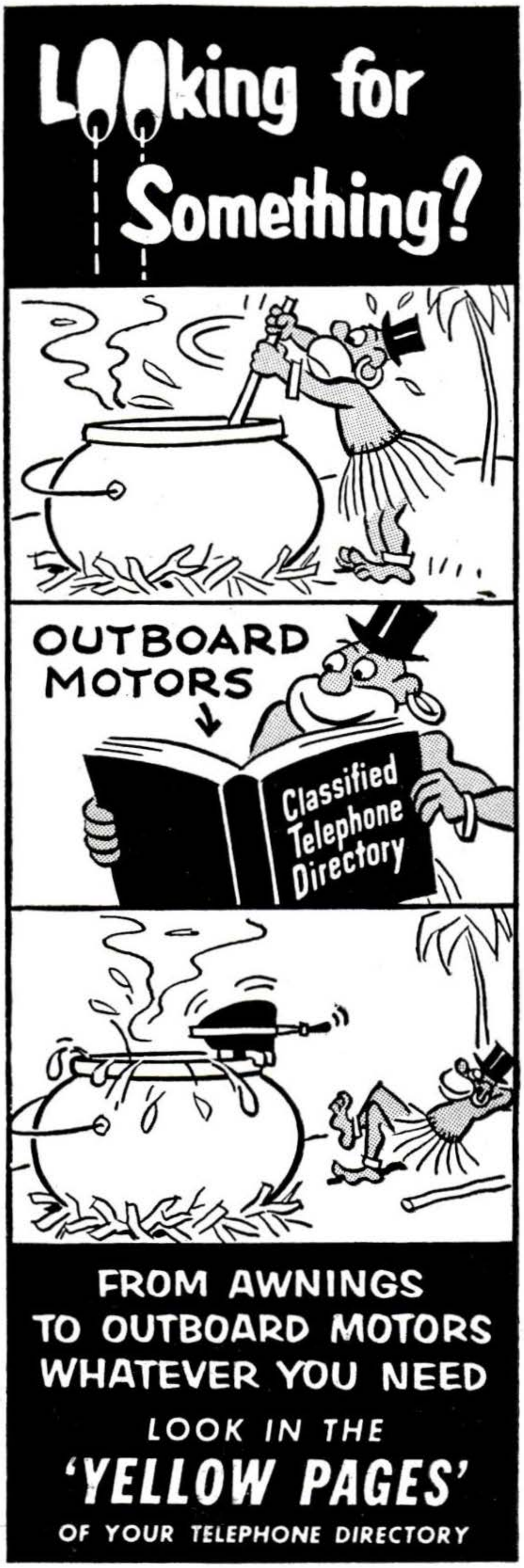

ABC's of Color Television
[Continued from page 83]

magazine covers. There, pigments subtract various parts from white light to create the desired shade.

Back porch: Part of the color TV wave that carries the color sync signal, which synchronizes receivers with the transmitter.

Chroma control: The knob that lets you adjust the vividness, or saturation, of the color picture. It doesn't alter the actual brightness of the image, or change colors, but will vary the intensity from pale pastels to deep shades.

Decoder: The primary-colored lights on the viewing screen that create the color image are controlled by primary-colored signals (red, green and blue). These, however, are not transmitted as such in the color TV wave. Instead they are scrambled into a code. It is the job of the decoder circuits in the receiver to unscramble the wave into the red, green and blue signals that the picture tube needs.

Electron gun: The phosphors on a viewing screen glow when struck by electrons, which come from a gun located at the other end of the picture tube.

Frequency interlace: The color TV wave carries about twice the load—information—that the black-and-white wave has. Yet it must fit into the same radio space—band width. This is accomplished by frequency interlace: the color signals are interleaved into spaces left empty in a black-and-white wave.

Green video voltage: The signal coming from the green camera tube or going to the green gun in the viewing tube. It corresponds to the green part of the picture.

Hue control: A receiver knob that helps keep red red, green green, and so on. It sets only the basic color and does not affect shading or brightness.

I signal: One of the three signals in the color-television wave as it is actually transmitted through the air. It is a code

[Continued on page 214]

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Make the picture perfect with a "Travelized" Ford!

There's nothing like a sweet-running Ford to make those carefree summer trips *perfect*.

The best way to make certain your Ford's in "trip-top" shape is to have it checked and "Travelized" *now*—before you go away. If replacement parts are needed, insist on the parts that are made *right* for your Ford—Genuine Ford Parts. They're made to the same specifications set by the men who originally built your Ford. And they're made to work right to last longer in your Ford!

Wherever you go for service insist on Genuine Ford Parts

GENUINE Ford PARTS

SURE SIGNS OF SAVINGS

Ford SERVICE

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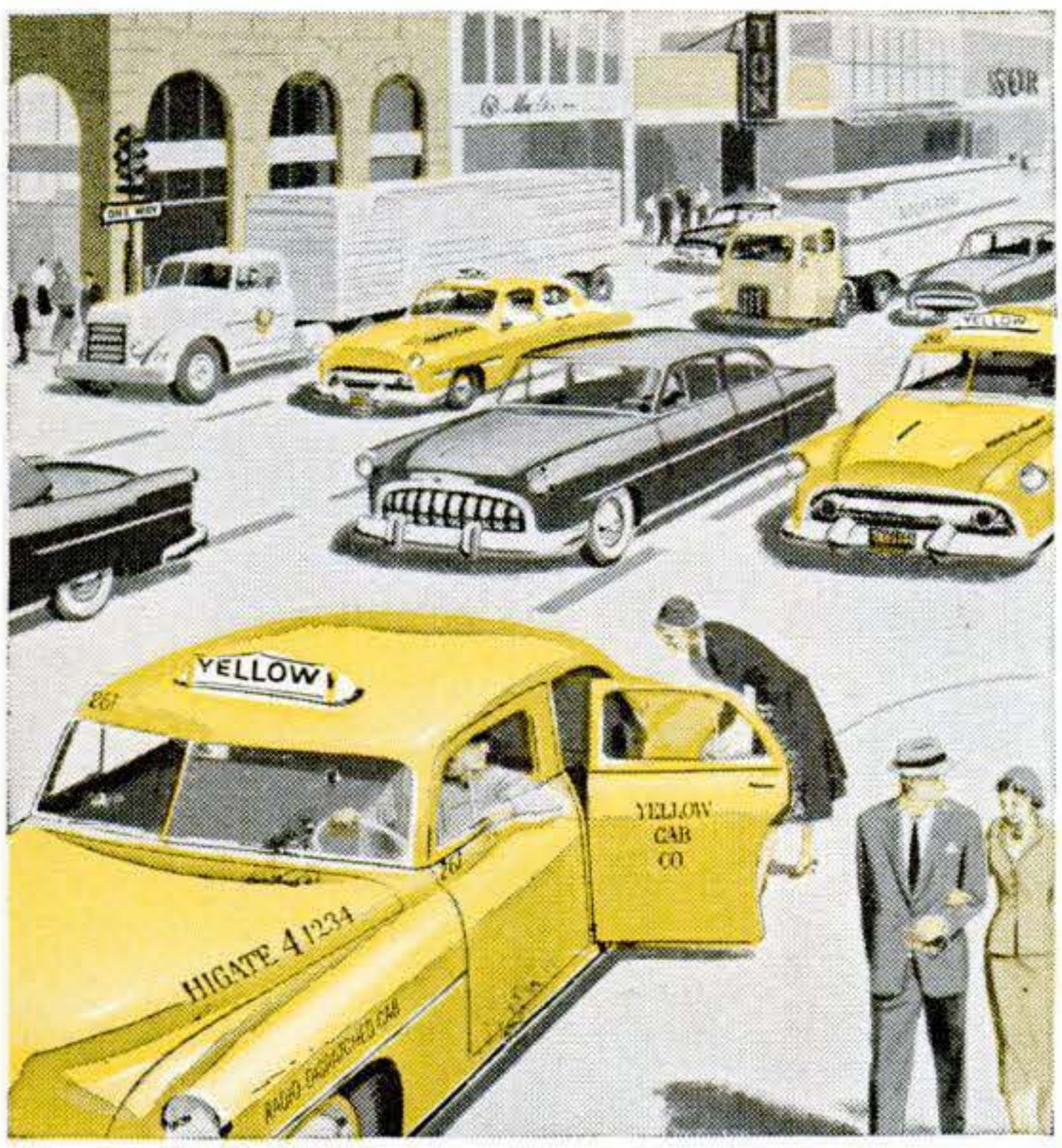

Get Good Performance the Way Big Fleets Do

Yellow Cab, Oakland, California, standardizes on Federal-Mogul oil-control engine bearings.

Yellow Cab Company rolls up more than half a million miles every month, delivering the good people of Oakland, California to their destinations.

Dependable performance is a Yellow Cab *must*. That's why they always replace with Federal-Mogul oil-control bearings on every engine overhaul.

Federal-Mogul oil-control bearings have led the replacement field for 30 years—because of quality. They will restore fine performance to *your* car, too. *Ask your mechanic!* FEDERAL-MOGUL SERVICE, Division Federal-Mogul Corporation, Detroit 13, Michigan.

for New Power . . .

FEDERAL-MOGUL

Oil-Control Bearings

BEARING MANUFACTURERS TO THE AUTOMOTIVE INDUSTRY SINCE 1899

BEARING FEDERAL Mogul SERVICE

[*Continued from page 212*]

made by mixing certain proportions of the red, green and blue signals from the camera. It contains information needed to reproduce colors ranging from bluish green to orange.

Jack: Socket on electronic equipment for plugging in test instruments or accessories.

Killer: Color sets can also receive black-and-white shows, but to do so properly their color circuits must be switched off. The killer tube does this automatically, being triggered when the incoming wave lacks a color sync signal.

Luminance: Technical term for brightness—how light or dark (not how pale or deep in color) the picture is.

Matrix: A circuit in the camera that mixes the red, green and blue signals from the camera tubes to create the I, Q and Y code signals to be sent through the air. A similar matrix in the receiver unscrambles the I, Q and Y signals back into the red, green and blue signals for the viewing tube.

NTSC: National Television System Committee, the electronics-industry group that worked out and gave its name to the present color-television standards.

Oscillator, subcarrier: A precisely controlled circuit in the receiver that governs the handling of the color signals.

Purity coils: Electromagnets on the color-picture tube that keep the three electron beams aimed correctly. Even a slight misalignment would cause the beams to hit the wrong color phosphor dots on the viewing screen, since these are very tiny and very close together. The result might be a green sky and red grass.

Q signal: One of the three signals in the color television wave as sent through the air. It is a mixture of the red, green and blue signals from the camera and contains information needed to reproduce yellowish green to purple.

Red video voltage: The signal coming from the red camera tube or going to

[*Continued on page 216*]

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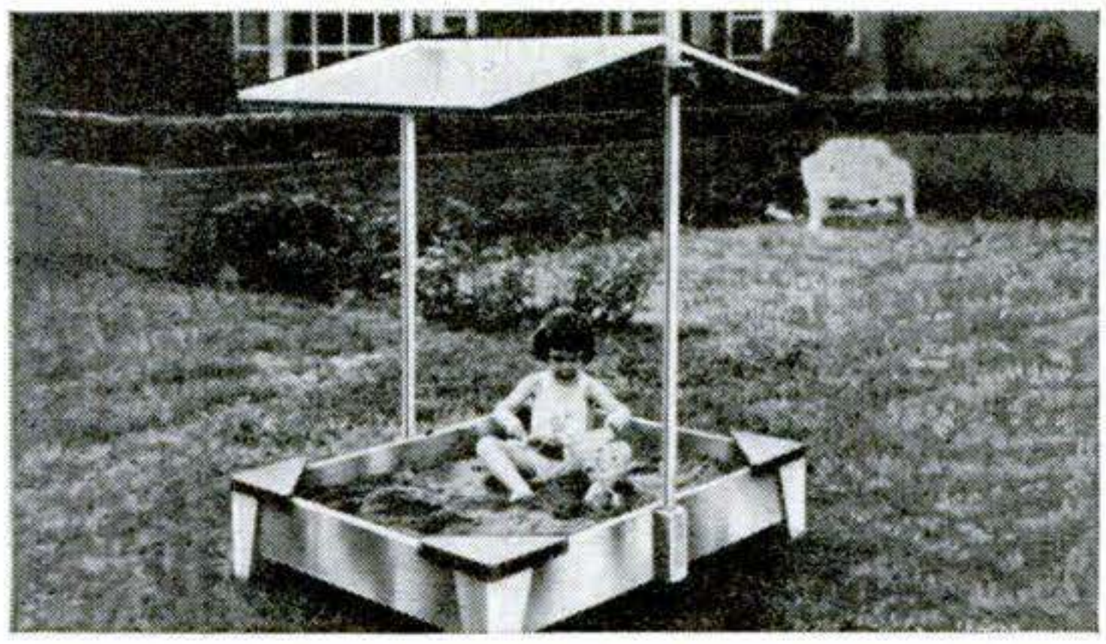
MAKE YOUR OWN PORCH and PLAY-YARD EQUIPMENT

for Outdoor Living this Summer!

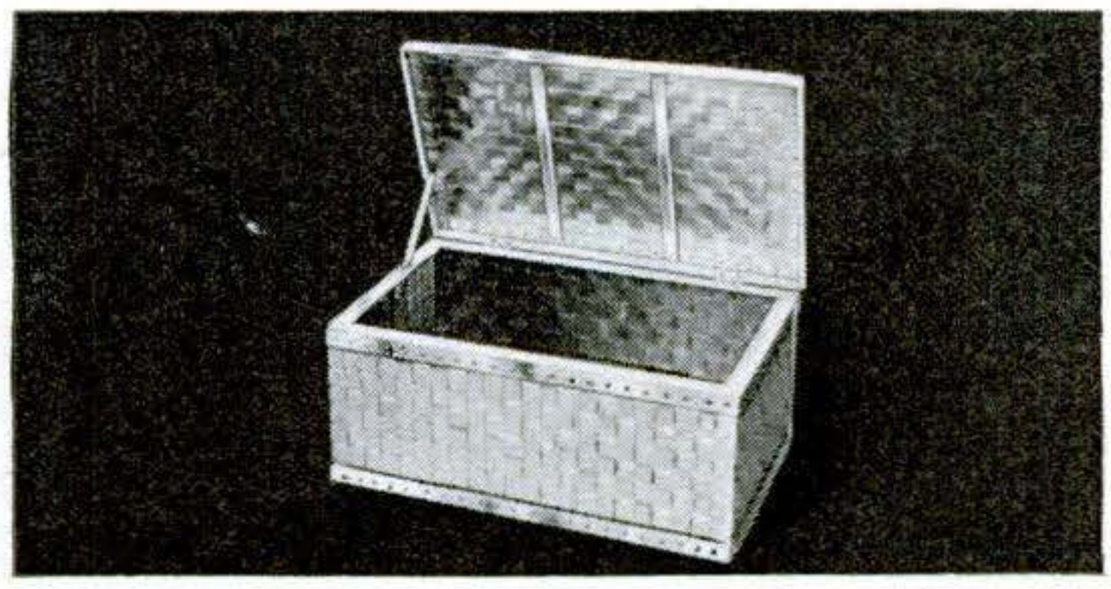
It's Easy and Simple to do with Amazing

REYNOLDS *DO-IT-YOURSELF** ALUMINUM



SAND BOX with Reflective Sun Shade provides happy hours for youngsters, protects them from hot sun. Shade adjusts to any height, lowers to serve as cover. Rustproof, *so* easy to clean. Plan #112, 25c with coupon.

FOLDING TABLE. Ideal for cards, informal eating, serving, base for portable grills . . . indoors or outdoors. It's *all* aluminum . . . stays bright and new-looking, won't ever rust. Reynolds Plan #110, 25c with coupon.



HANDSOME PICNIC HAMPER is a picnic to make with Reynolds *Do-It-Yourself* Aluminum. Sturdy, lightweight, plenty of room for food and picnic equipment. Reynolds Plan #111, 25c with coupon.

It's no trick at all to make things with amazing Reynolds *Do-It-Yourself* Aluminum. All you do is follow any of our simple plans (see coupon below) . . . and make things that would do credit to a professional craftsman.

Easier to Work than Wood . . . this fabulous material is specially engineered for use with *standard* woodworking hand or power tools. You can saw it, drill it, plane it, joint it, just like you do wood. And think of the other advantages: Reynolds *Do-It-Yourself* Aluminum is bright and beautiful, it's strong and sturdy, and it will never rust . . . perfect for outdoor use as well as indoors. Mail the coupon for the simple Reynolds Plans today.

CAUTION: Use only Reynolds *Do-It-Yourself* Aluminum . . . ordinary aluminum may harm tools. Look for special Seal (shown on coupon) attached to each piece.

SMART PORTABLE SERVING CART . . . a marvelous convenience indoors and outdoors. Light, functional and rustproof, it's a simple job with this fabulous Aluminum. Reynolds Plan #114, 25c with coupon.

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- ☐ How-to Booklet containing general instructions and suggested projects . . . . FREE

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ABC's of Color Television

[Continued from page 214]

the red gun of the receiver picture tube. It corresponds to the red part of the image.

Saturation: Technical term for vividness of a color—scarlet is more saturated than pink, for example, although both are the same *hue* (red) and could be the same brightness. The chroma control on the color receiver adjusts saturation.

Three-gun tube: Most of the color picture tubes now being made have three electron guns, one for each primary color. Single-gun tubes are also being developed.

UHF: A band of TV frequencies, recently authorized, with 70 channels and ranging from 470 to 890 megacycles.

VHF: A band of television frequencies, in use since 1946, containing channels 2 through 13 and ranging from 54 to 216 megacycles.

White level: Part of the television wave that limits the "whitest" white the picture can reproduce. The black level sets a similar limit to the "blackest" black.

XMTR: Abbreviation for transmitter.

Y signal: One of the three signals in the color-television wave as sent through the air. It is a mixture of the red, green and blue camera signals, but so proportioned that it contains brightness information rather than color information. It is almost identical to the standard black-and-white TV signal. When ordinary black-and-white receivers are tuned to a color telecast, they use the Y signal (disregarding the I and Q signals) to reproduce an excellent black-and-white image of the color picture. This is what makes the system compatible.

Zero reference: A point from which measurements are made. The color sync signal, for example, is zero reference for setting the I and Q signals. END

Horse Sense

On a questionnaire asking: "What is the principal contribution of the automobile age?" a student replied: "It has practically stopped horse stealing."—*Pure Oil News.*

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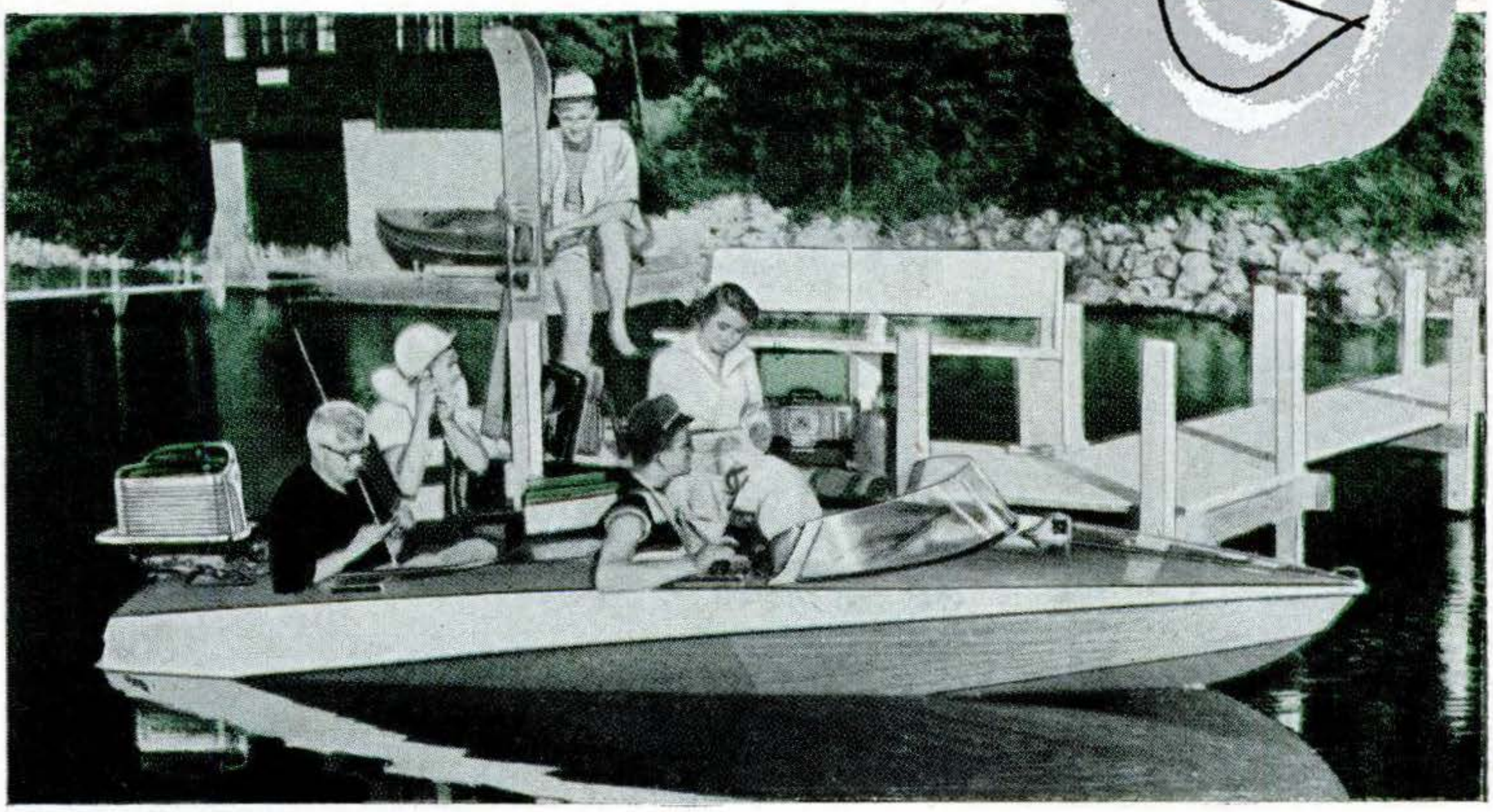

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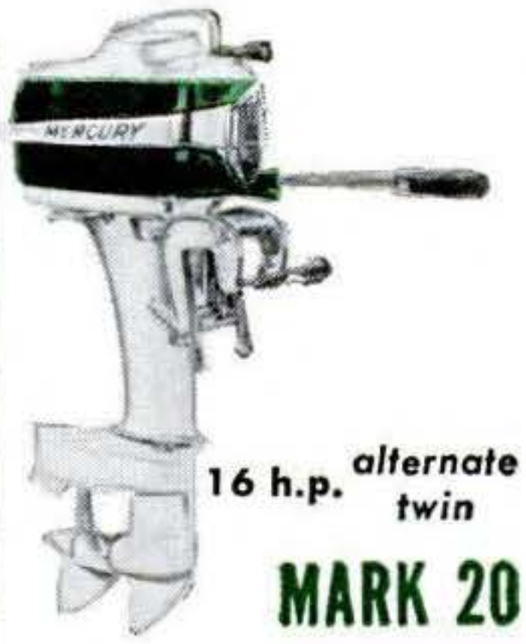

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MARK 20

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• Reliable Rocket engine • Duo-Flex Propeller Clutch—no shear pin • Waterproof Magneto and Spark Plugs

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The Great Windshield Mystery

[*Continued from page 59*]

of the independents, I saw C. H. Cronin, a harried man with two jangling telephones.

"We're coming out with an official statement," he told me. "We can't find a thing in this pitting business. Our research director, Dr. Frank Cox, has had his lab really working over sample windshields flown in from Seattle and elsewhere. Microscopes, X-ray diffraction, scintillation counters—the full treatment.

"All marks on windshields flown in here have been caused by marks from gravel, cinders and the like. We can produce microscopically identical marks in the lab, just by hurling the same materials at new glass. No radioactivity; no chemical attack; no electrical attack; no temperature sensitivity."

Cronin paused to cope with his telephones. "The windshields shipped in," he went on after a moment, "show what glass men call 'crush marks'—local impact damage. We ran some X-ray diffraction analysis on stuff that was supposed to have been collected from pitted glass in the Midwest. Turned out to be asphalts and dolomite, which are common road materials. Those radioactivity rumors are cockeyed—long exposure to intense radiation doesn't pit glass."

He described how in one community that had been studied the pox had appeared suddenly, swelled in one weekend to an epidemic, and then died. Apparently it started when a local broadcaster, after airing the story of the Bellingham pittings, had gone out and studied his own windshield. He found a crush mark and called the state police. A trooper and he found other marks on other cars. They dug up a local college professor with a Geiger counter, who pronounced the pittings "positively *not* radioactive." Then, somehow, the situation blew up; in hours the wires out of town were carrying excited tales of how the windshields of "nine out of every 10 cars in town" had suddenly become mysteriously pitted.

[*Continued on page 220*]

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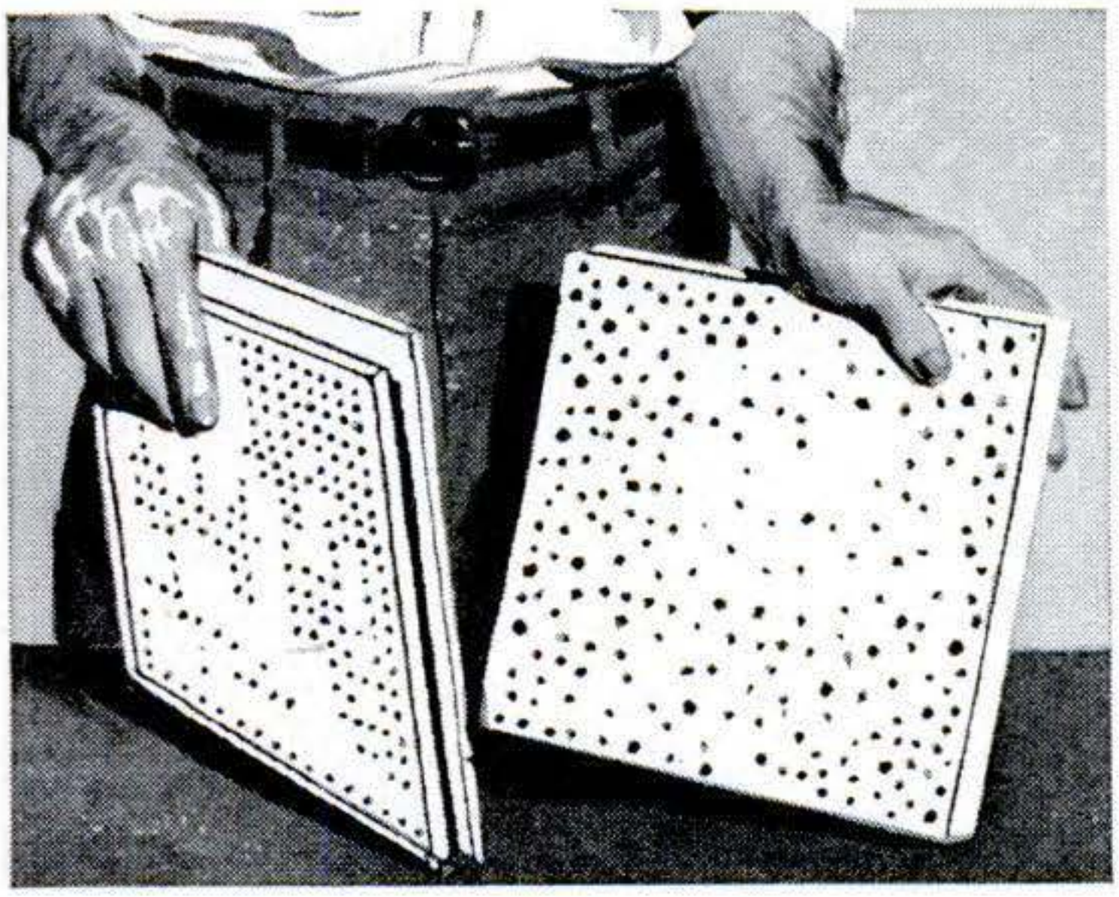
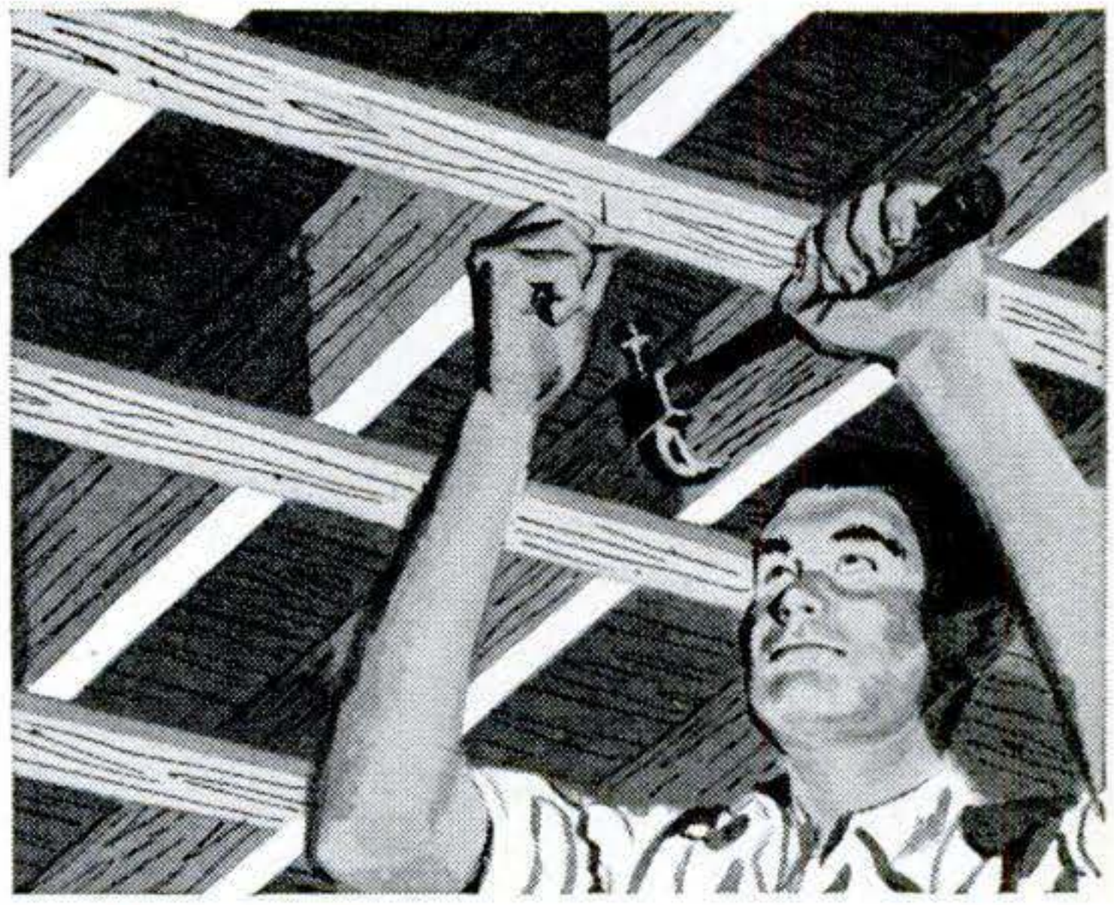
Install this noise-muffling ceiling yourself

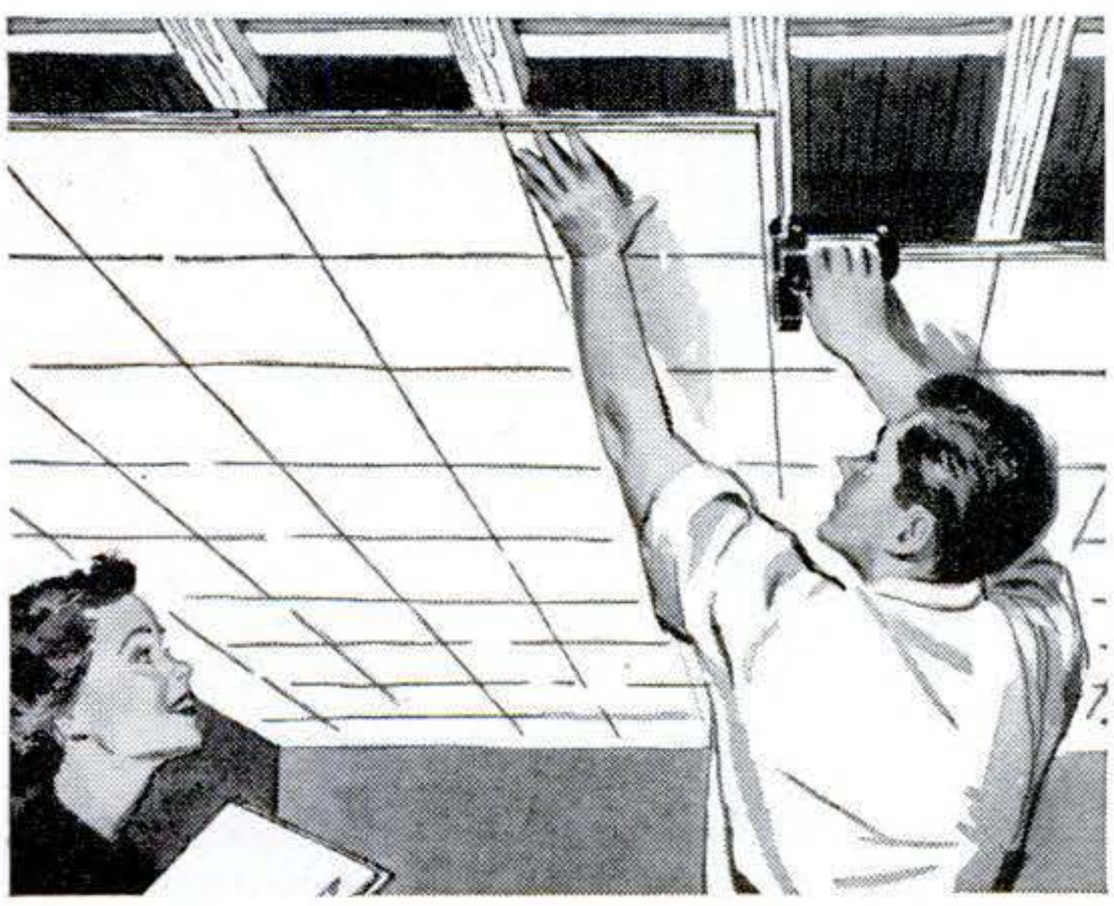
Why let noise take the fun out of your basement playroom? You can provide comfortable quiet —and have a handsome ceiling finish, too—simply by installing a noise-absorbing ceiling of either Armstrong's Cushiontone or Perforated Temlok Tile. It's easy, economical—do it yourself.



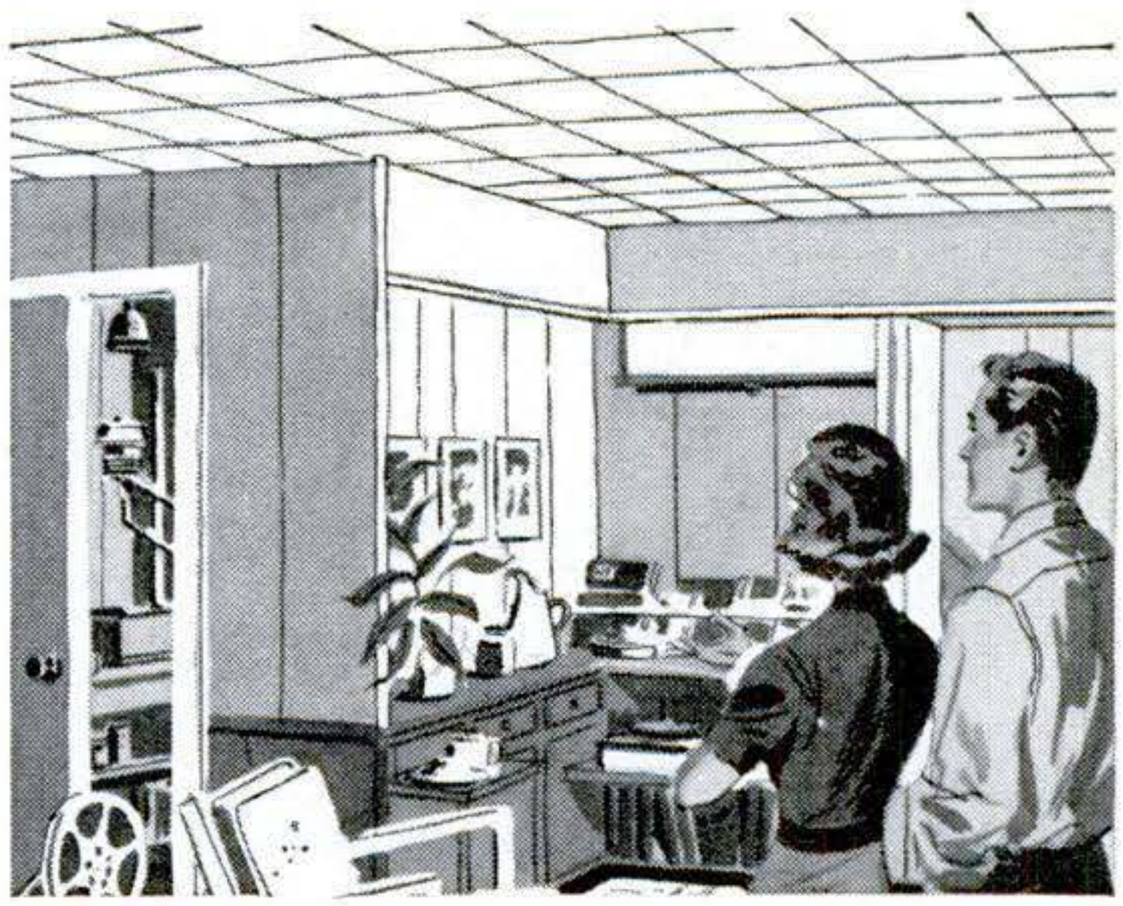
1. **Both Cushiontone** and Temlok Tile are perforated wood fiber materials. Cushiontone's noise-trapping holes are arranged in Armstrong's exclusive new "Full Random" pattern, while Temlok's perforations are in neat, straight rows. Both materials are factory finished, can be washed or repainted if desired.



2. **Start by nailing** up seasoned wood furring strips as a base for installation. 1" x 3" strips should be nailed at right angles to the joists on 12" centers. Shim the furring where needed to provide a smooth, level surface. Cushiontone can also be cemented direct to plaster or other smooth surfaces.



3. **The special** Lok-Bevel joint with its extra wide flange speeds nailing or stapling of Perforated Temlok Tile. The shallow-drilled nailholes in each corner of Cushiontone also help to make installation quick and easy. When nailing up Cushiontone, use nails with flatheads or collars 1/8" to 5/32" in diameter.



4. **In a few hours,** your noise-absorbing ceiling will be finished—a beautiful and practical ceiling for your playroom. Your whole family will be so pleased with the new-found quiet, you'll also want to sound condition your kitchen, workshop, or den with Cushiontone or Perforated Temlok Tile.

Your building materials dealer will be glad to give you full details on Full Random Cushiontone, Temlok Tile, and Armstrong's other building materials. For a free booklet on Cushiontone and Temlok acoustical ceilings, write Armstrong Cork Company, 4207 Washington Avenue, Lancaster, Pennsylvania.

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The Great Windshield Mystery

[*Continued from page 218*]

The mystery evaporated under careful scrutiny. Pittsburgh Plate sent a man who studied more than 150 windshields in town. He found only conventional crush marks, in amounts that would be expected in a community with gravel roads nearby. Older cars and those with high mileage had the most marks, including those that had been parked in protected garages during the period of "mystery." Twenty-five brand-new cars stored outdoors during the epidemic showed no marks at all. High-mileage cars with marks also had evidence of stone damage on the headlights and metal surfaces.

A phone jangled and Cronin began patiently to explain "disintegrating" glass to an inquirer. I tiptoed out.

The library story. Back in New York I discovered a fascinating volume in PSM's library. Called "On the Objective Study of Crowd Behavior," by L. S. Penrose, M.A., M.D., it is a scholarly British tome on the infectious properties of ideas.

It offered the best explanation yet of the great windshield mystery: People saw pits because they had been led to look for pits. Says Dr. Penrose:

> The course of any craze is marked by certain phases . . . which follow closely the pattern shown in an epidemical physical disease. First there is a latent period . . . Next comes the phase during which time the idea spreads rapidly. The number of people who accept the new idea mounts with an increasing velocity which may develop an almost explosive character. As the market of susceptible minds becomes saturated, the velocity of the wave . . . begins to slacken. This is the third phase. The fourth phase is marked by the development of mental resistance against the idea, which resembles immunity to infection in the sphere of physical disease. During this period the mental infection wanes; in those already infected the enthusiasm becomes weaker, and there are few new cases . . . END

Next month Frank Rowsome Jr. tells you the truth about your car brakes.

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QUESTIONS and ANSWERS

about Kaiser's supercharged "power-on-demand"

Q: What is "power-on-demand"?

A: "Power-on-demand" is the new kind of power produced by Kaiser's newly designed Super-power Engine, with supercharger. It combines breathtaking acceleration and performance with small-car economy.

Q: Where else are superchargers being used today?

A: Almost every airliner you ride in uses superchargers to gain speed and altitude. They are also used in some racing cars and expensive custom jobs.

Q: How is Kaiser's supercharger different?

A: Kaiser's is a variable-drive supercharger, controlled by a solenoid switch on the accelerator. It operates whenever the engine is running, with slight output at normal speeds and maximum acceleration instantly when you step down on the gas. It's virtually silent in operation.

Q: How does it work?

A: It forces the fuel-air mixture into the combustion chamber under high pressure, for faster, more effective combustion, thus preventing starvation in any cyclinder, *even when driving at highest altitudes.*

Q: Is it available on any other car?

A: No. It was developed by Kaiser and McCulloch engineers as an integral part of the new engine for the '54 Kaiser Manhattan—the only production car factory equipped with a "blower."

Q: How many horsepower does Kaiser's supercharged engine develop?

A: Up to 140 h.p. at 3900 r.p.m., and up to 215 pounds of torque at 2400 r.p.m.

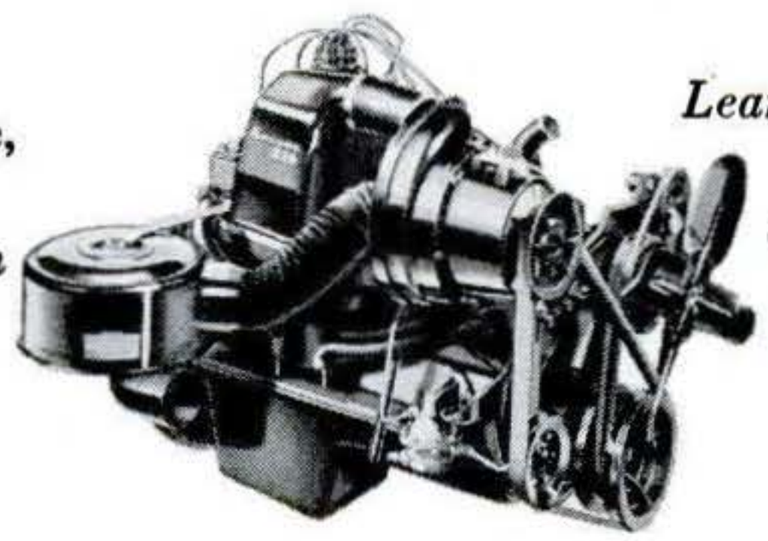
Q: Is it expensive to operate?

A: No. The small engine displacement saves money in normal driving—you pay for extra power only when you use it.

Q: How does it work with Hydra-Matic?

A: "Power-on-demand" *plus* Dual-Range Hydra-Matic* is the next step ahead in effortless driving. (Overdrive* also available.) Your Kaiser dealer will gladly arrange a test drive.

**Optional at low extra cost.*



Learn more about "power-on-demand" at your Kaiser dealer's.

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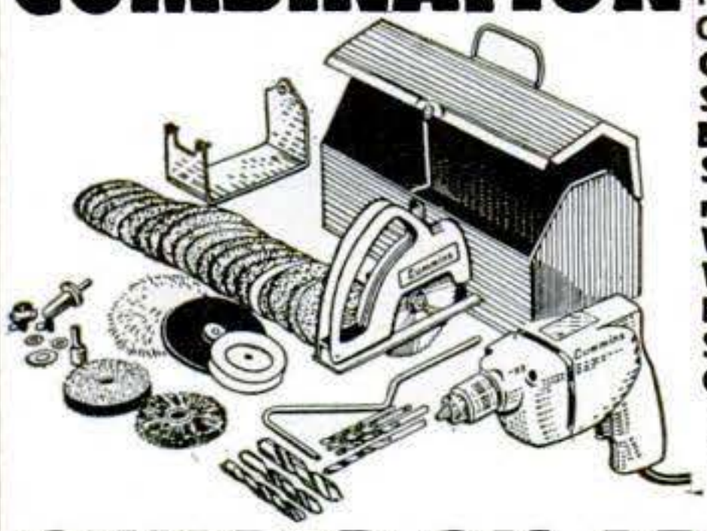

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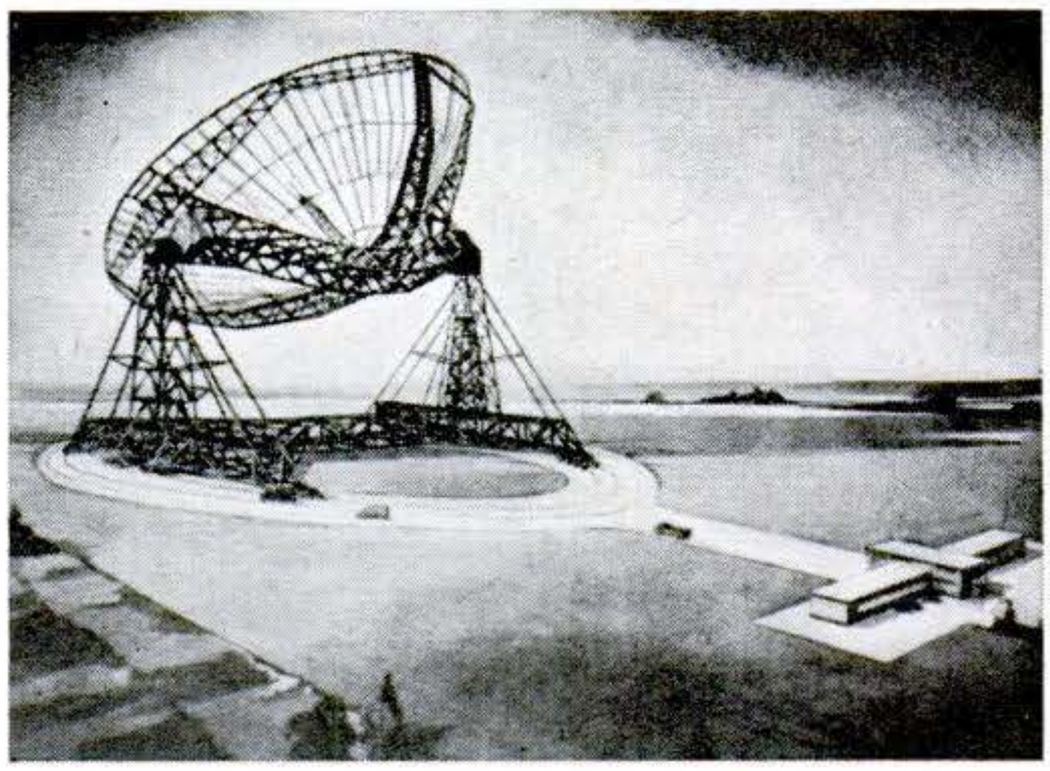
Looking into Space with Radio Eyes

[Continued from page 80]

instruments' inferiority to optical telescopes in resolving power, the ability to define details clearly, which depends upon a telescope's diameter *measured in wave lengths.* It would take a radio telescope as large as the Pacific Ocean to match the resolving power of the 200-inch Palomar telescope!

What is next-best? One answer is to



LARGEST OF BOWL-TYPE radio telescopes, this 250-foot-diameter giant is being built at Manchester, England. Two high towers will rotate with it on a circular railway track.

build a single radio telescope as large as physically possible. Due for completion at Manchester, England, in 1955 is a bowl-type radio telescope of record 250-foot diameter, steerable toward any part of the sky. Under direction of Prof. A. C. B. Lovell, work on the million-dollar instrument is well advanced.

Another answer is the interferometer-type radio telescope, with two or more aerials, up to one-third of a mile apart, joined by cables to one receiver. The effect is as if the aerials were small portions of one gigantic one. The new Cambridge radio telescope is of this type —a "double interferometer"—unprecedented in resolving power, as well as in size. To sweep the heavens, it depends upon the earth's rotation. Meanwhile a wavy line upon a chart records incoming radio waves' strength. Its units tilt to cover the sky in strips.

Observations with these two new instruments should bring about the next great advance in radio astronomy. END

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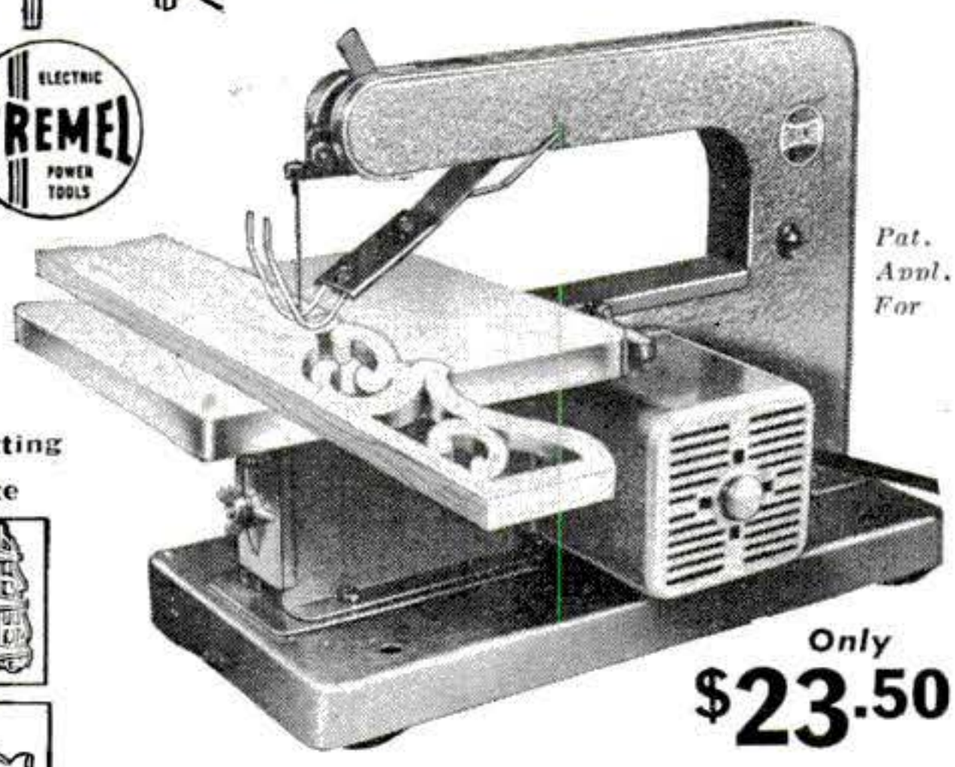

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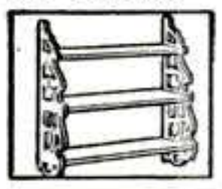

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Buy Only DFPA-Grademarked Panels

Beware the Ugly Sting Ray!

[Continued from page 118]

Dr. Russell's project started out, rightly enough, as a standard laboratory problem. There was one hitch, however; sting-ray venom was not exactly a commonplace commodity. So, before he could even begin to work, Russell had to shut up his laboratory and go fishing.

He's been fishing ever since, and though other fishermen think he's crazy, he calls a fishing trip a complete success only when he can bring back a nice mess of sting rays. Though his interest in the sting ray is strictly scientific today, it can probably be traced back to the day when he got stung by one. Between that day and this he has learned a good deal about this unattractive fish.

Sting Ray Comes from Big Family

There are enough varieties of sting rays in the seas of the world to confuse the most orderly ichthyologist. They range all the way from the giant stingaree of Australia, weighing up to 700 pounds, down to the small round sting ray, rarely more than 20 inches long, which is common to the waters off southern California. Cousins of this small ray are found off the south Atlantic states and in the Gulf of Mexico.

The sting ray has few natural enemies, which is one reason the tribe continues to increase. Several species of shark prey on it, but pay heavily for this foolishness. These sharks are often found with as many as a dozen of the barbed stings in their stomachs.

There is no real way of telling how many people get stung every year, but a check of lifeguard stations along a 100-mile stretch of the southern California coast, from Santa Monica to San Diego, showed that over a seven-month period, from April to November, 1952, there were no less than 390 sting-ray "attacks."

When Russell goes after big rays he heads for the Mexican town of San Felipe, on the Gulf of California, some 120 miles below the U.S. border. In the heat of summer the rays sometimes swarm

[Continued on page 226]

BUILD YOUR OWN MODEL OF THE M.G. SPORTS CAR!

Here's the ultimate in craftsmanship — a realistic replica of the famous British M.G. — finest model kit ever produced!

This **Model** masterpiece has more than 50 precision-fitted parts, including steerable front wheel assembly, semi-pneumatic tires and semi-elliptical rear springs — yet it requires only a screw-driver for assembly. Body is durable die-cast construction, chassis is heavy steel. Comes with gray primer coat — can be painted to your preference.

An absorbing, educational "father-and-son" project, the **Model MT** is a rugged, thrill-packed toy when assembled — or a handsome collectors' item for sports car owners and hobbyists.

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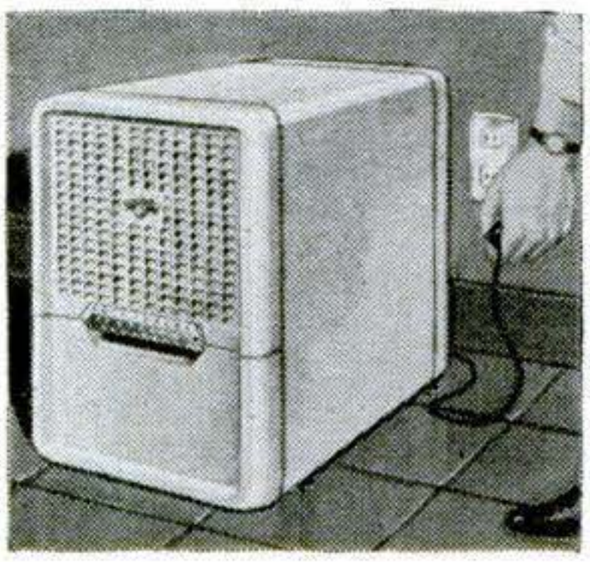
Drive out *Basement dampness*

with the amazing **FRIGIDAIRE** electric **DEHUMIDIFIER**



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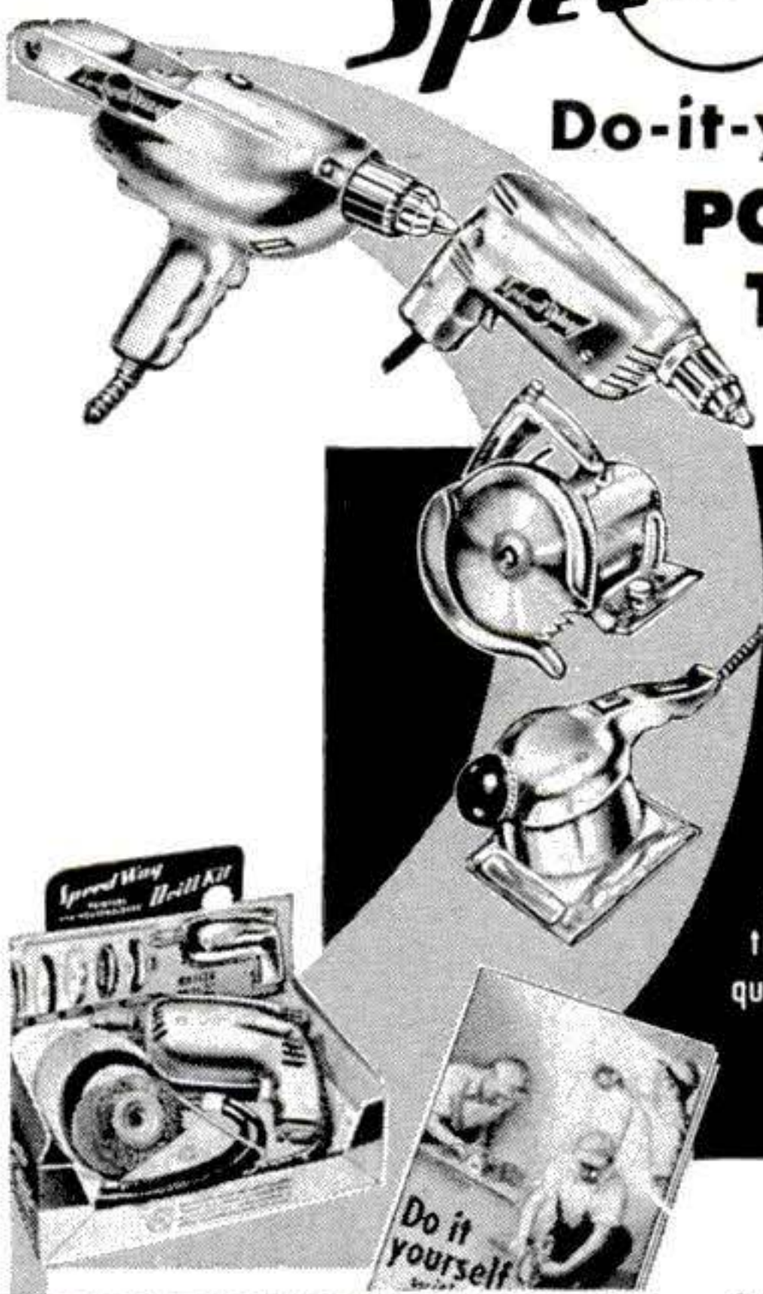

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Beware the Ugly Sting Ray!

[Continued from page 224]

into this protected harbor in such numbers that they pancake out of the water as they jostle for favored locations.

Russell and his colleagues use various systems for collecting rays. Sometimes they set gang lines, with 50 or 60 baited hooks—and can usually count on hooking an average of 10 rays, and as many sharks. Beach seining, in which a net is taken out by rowboat, set in 15 or 20 feet of water, pulled across the bottom, and hauled onto the beach by a team of four men, usually yields plenty of rays in season. And a day on one of the shrimp boats that put out from San Felipe yields even more. When the nets are pulled in, every two hours, they are often filled with as many sting rays as shrimp.

Some Fishermen Use Spears

The most sporting method of all is to track the rays down and spear them. The scientists, in a 16-foot boat with an outboard, crisscross the bay at San Felipe until they spot a good-sized ray sunning itself on a sand bar. Russell, in the bow of the boat, takes aim with his spear gun and fires down into the water. As the spear, with its tow rope arcing behind it, finds its mark, the big ray thrashes wildly, then takes off for deeper water.

There is nothing for the men to do but hang on and wait for the ray to wear itself out, as the boat drags along in the big ray's wake. Depending on the size of the ray (and Russell has caught them here all the way up to seven feet across) it will be a half hour or more before the ray is tired enough to be safely hauled in.

Working cautiously and quickly, Russell chops off the ray's tail at the base, and the big fish is pushed back into the water. Though it has lost its defensive weapon, it is quite capable of going on about its business.

The tail is promptly stored in a dry ice chest. Then, as soon as they get back to shore, the scientist-fishermen get to work. In a house trailer converted to a small laboratory, they scrape the tissues from

[Continued on page 228]

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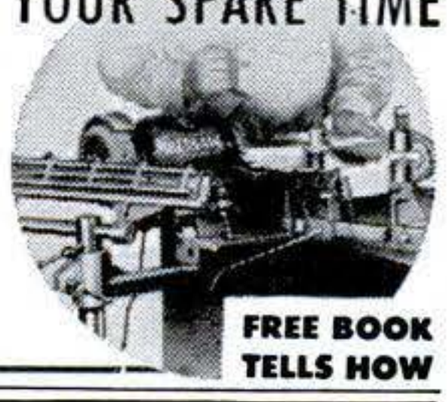

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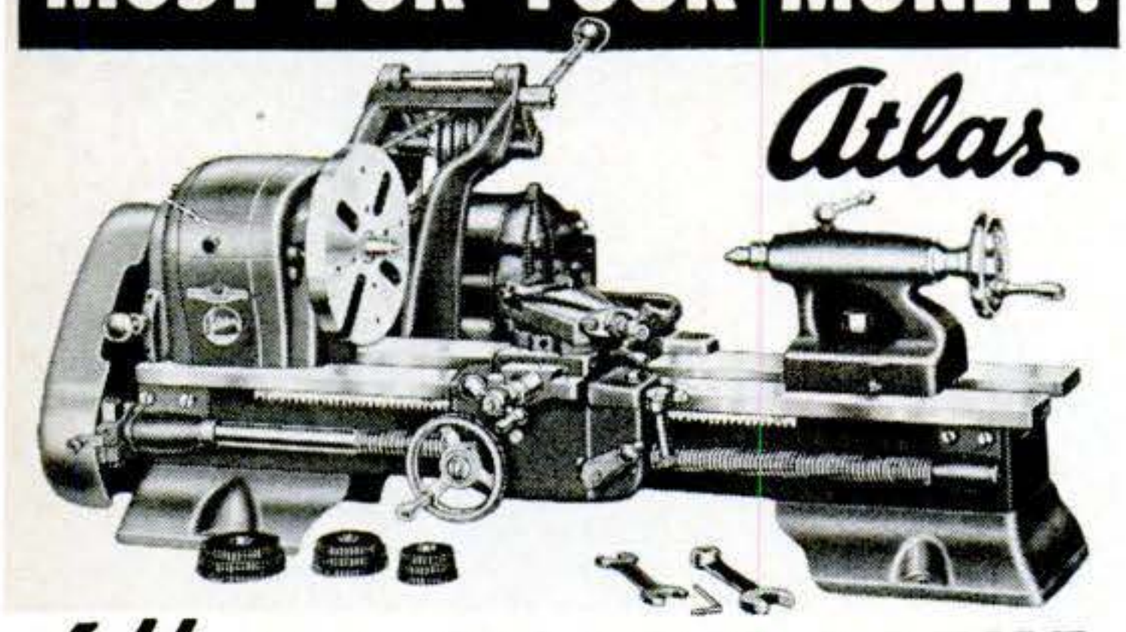

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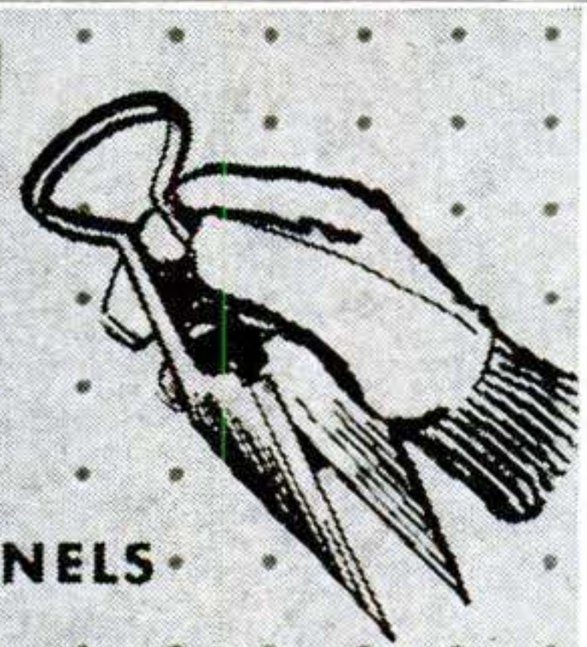

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Beware the Ugly Sting Ray!

[*Continued from page 226*]

the barbed stings they have collected, grind the material up, spin it down on a centrifuge, and draw off the extract. The distilled sting-ray venom is then ready to be used in experiments.

While it is fortunately rare, men have undoubtedly died from the effects of this poison. Working with the venom at the California Institute of Technology and at the Huntington Institute for Medical Research in Pasadena, California, Dr. Russell recently discovered that the venom from a 1½-inch sting, injected intravenously, is enough to kill a rabbit within a few minutes. Small wonder that human victims of the sting ray feel pain.

Sting Rays Lurk on the Bottom

Sting rays like warm, quiet water. If they are not actually buried in the sand or mud on the bottom, they will be swimming near the bottom. Whenever you are wading in areas where you suspect that there are sting rays, it is wise to shuffle your feet, rather than step along naturally. Russell and his co-workers have found that when they do this the rays usually swim away.

If you are stung by a ray, wash the wound out at once with the cold salt water at hand. A constriction band can be put above the stab site. Then, when the wound has been thoroughly irrigated, and seems completely clean, soak your foot or leg in hot water—as hot as you can stand it—for as long as an hour. Then the wound should be covered with a sterile antiseptic dressing. If your injury seems severe, better see a doctor.

Of course you won't ever need any of this advice if you'll just remember that the sting ray is anything but a belligerent fish; it probably never uses its sting except in self-defense. So join those other smart fishermen and bathers—and give the sting ray a wide berth. END

No Short Cut

You can't be safe by accident.—*Viking Vacuum.*

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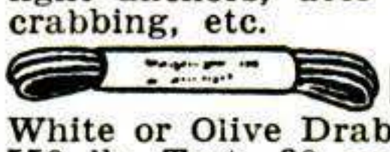

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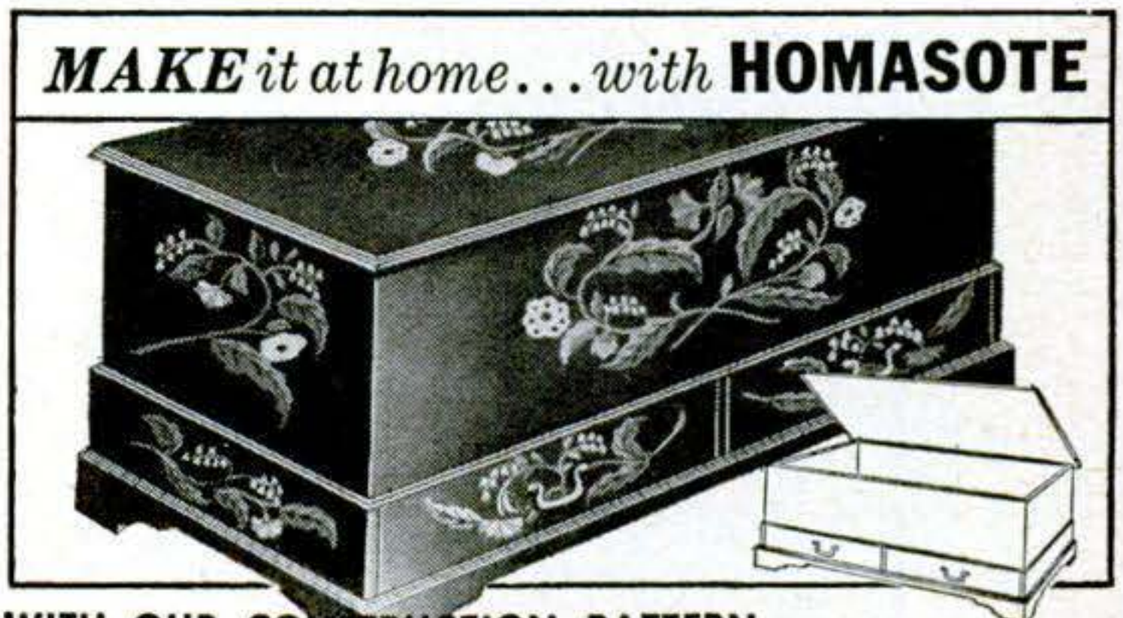

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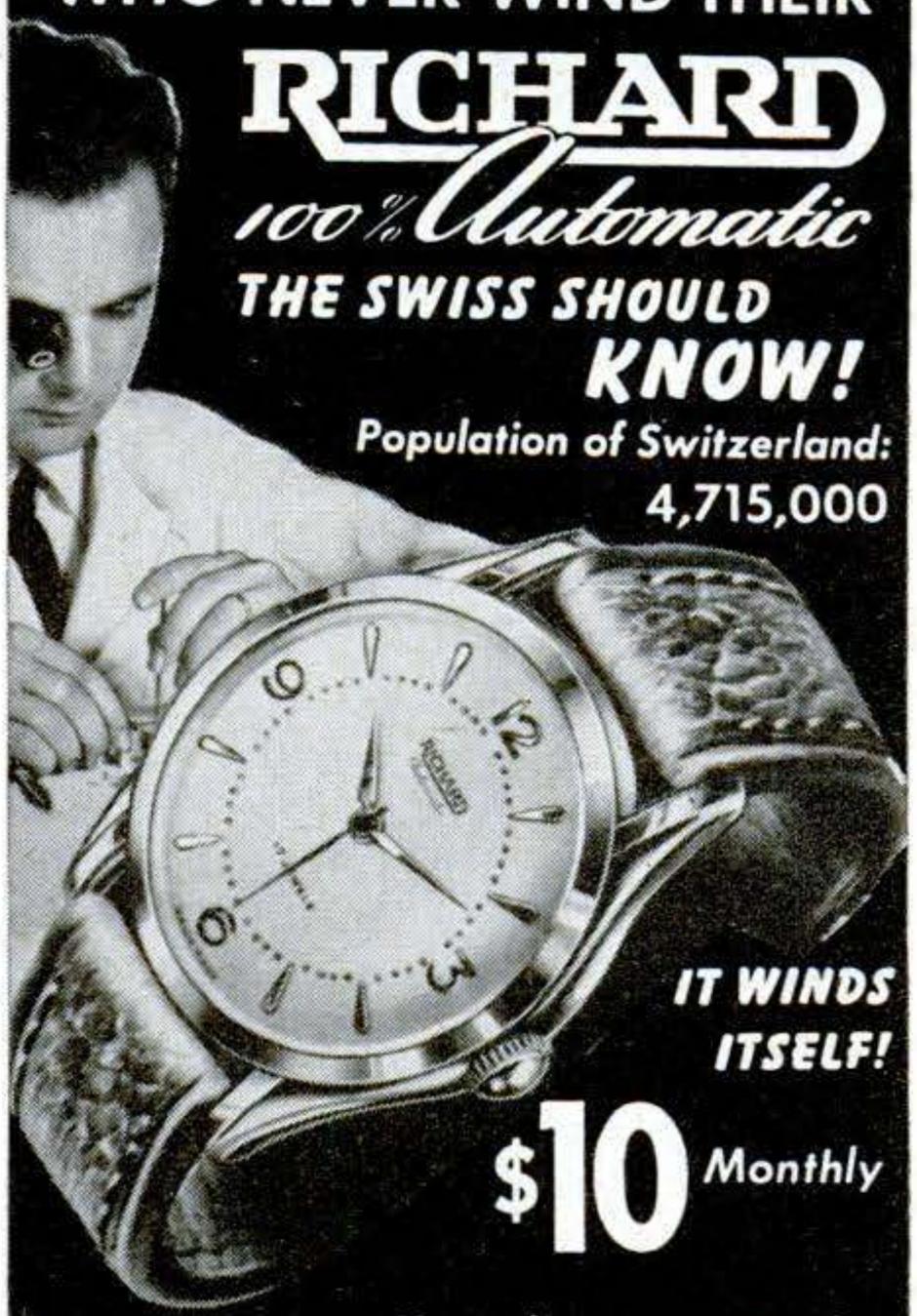

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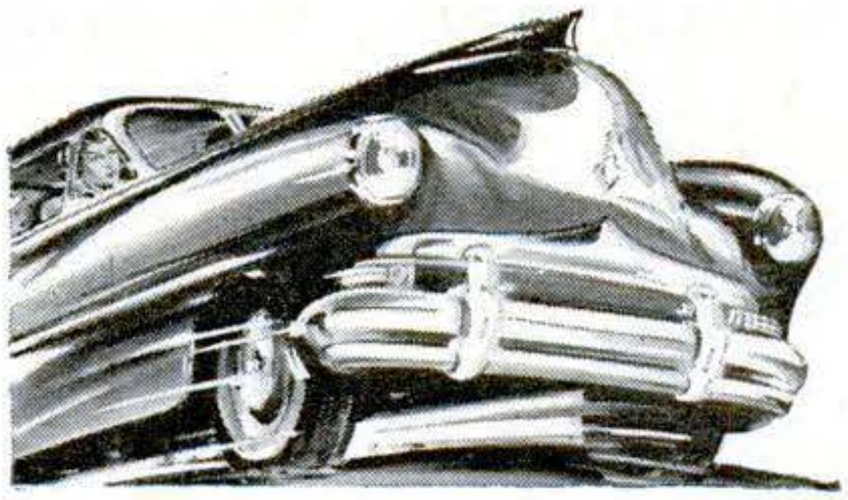

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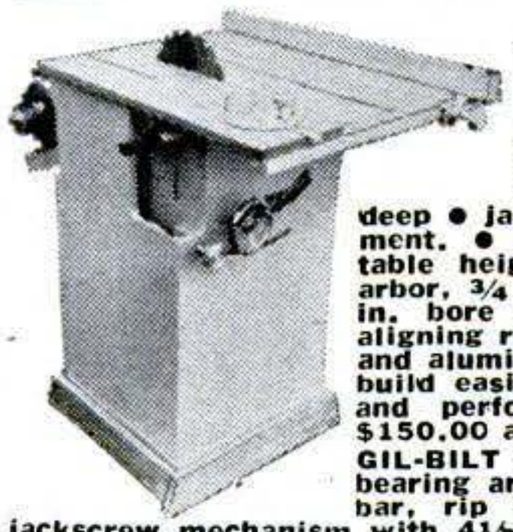

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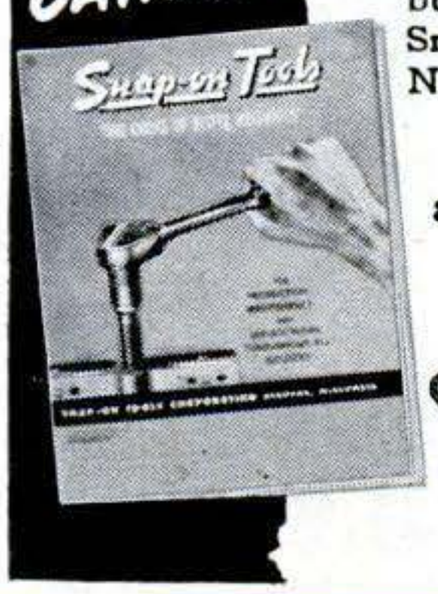

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Snap-on Tools Corporation
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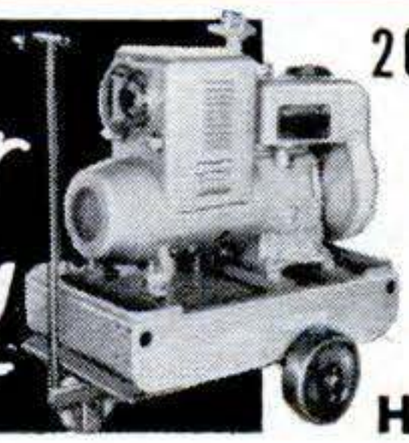
New Arc Welder Costs Little, PAYS BIG!



200 amp. Air Cooled Engine Driven

The Hobart "Husky Boy" gives fast, strong welds at lower cost. It's light, rugged and compact . . . welds anywhere. Designed to handle both general shop and outside repair work, it's a real profit maker anywhere! Cash in on "big pay" emergency repair work.

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A. C. Welder Transformer Type AC Welder for shop use on single phase power.

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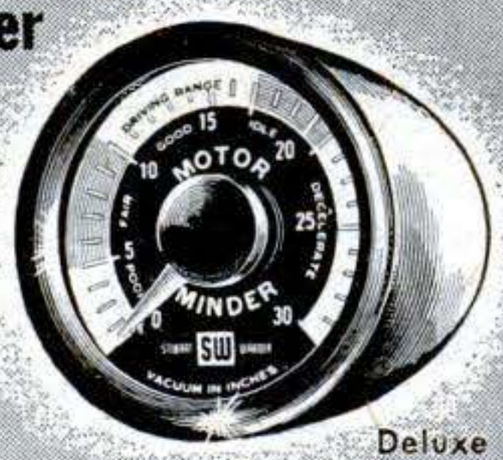
New! Stewart-Warner
MOTOR MINDER®



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Makes every trip an economy run

Mounted on your dashboard, Stewart-Warner's new driving gauge and engine analyzer tells as you drive how to get more miles per gallon—how to get top performance from your engine.

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STEWART-WARNER
Instrument Division, Department P-74
1840 Diversey Parkway, Chicago 14, Illinois

Boeing's Jet Stratoliner

[*Continued from page 124*]

Appropriately, the company has decided to call its jet transport the Stratoliner. The airplane's immediate predecessor was the Stratocruiser, a common sight in the skies of Reykjavik and Rio, Singapore and San Francisco. There was a previous Stratoliner. It was the first of the U.S. four-engine land transports. But only nine were manufactured, and that was 15 years ago.

When will you be able to fly in the first American jet transport? That depends. The Stratoliner must go through its proving trials. It must be approved for carrying people. It must be built in numbers so that a regular service can be established by one or more airlines.

Project for the "Dream Department"

There are straws in the wind. Captain Eddie Rickenbacker, head of Eastern Air Lines, was so interested in jet transports that he flew to England to look at the Comet. Pan American World Airways has an order in for jets. The dreams department of United Air Lines has been making theoretical jet flights from coast to coast every day for more than a year. Other U.S. transport-airplane manufacturers are planning jet airliners.

It wouldn't be a bad guess that you will be able to buy a ticket on U.S. jet transport by a year from next summer, maybe sooner.

Meantime, hearken to that drawl out Seattle-way. It's Mr. A. M. (Tex) Johnston giving sweet-talk to 95 tons of jet airplane as he eases forward on the throttles. It's likely that he's saying to his co-pilot, "Jest you settle back in yore seat and relax, son, because hyer we go!" END

A Moving Question

A little girl, riding on a train for the first time, pointed to some trees and asked, "Mommie, what are those?"

"Those are trees, dear," answered the mother.

"Where are they going?"—*Fireman's Fund Record.*

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For light work—stamping, forming, riveting, etc.—Metal, fiber or other material.

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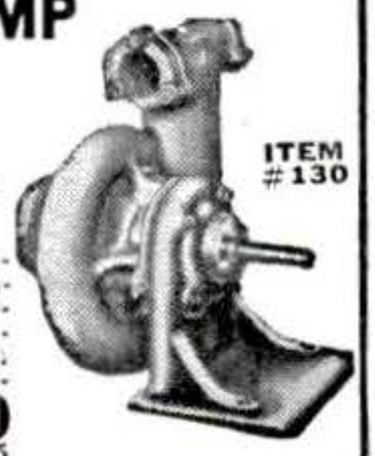

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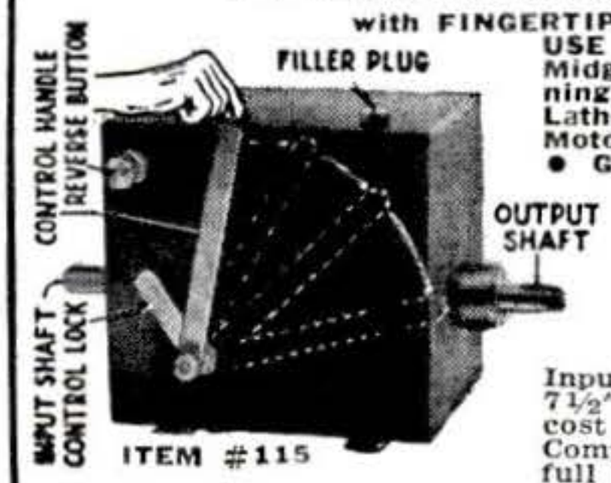

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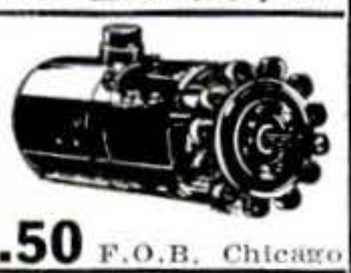

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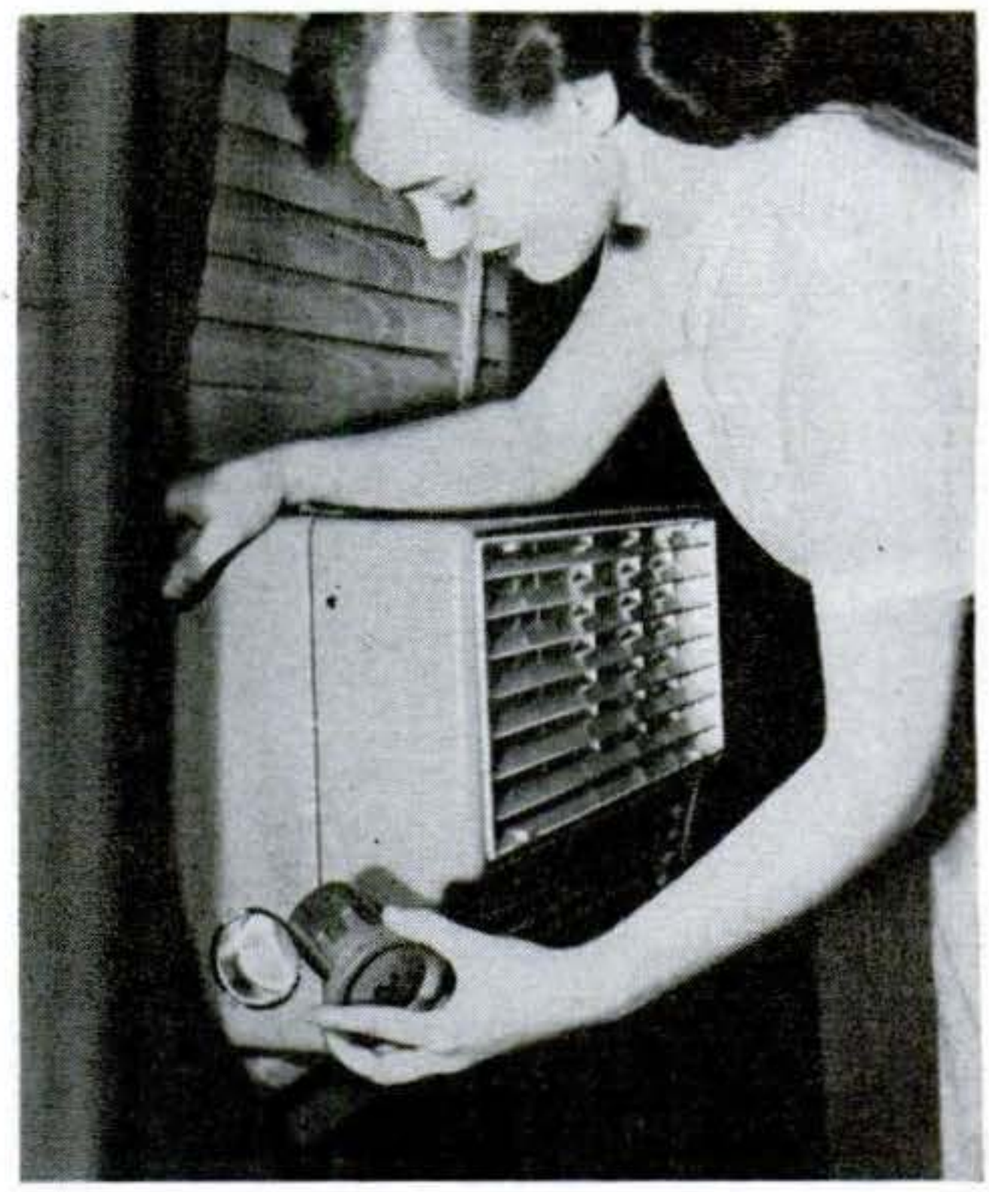

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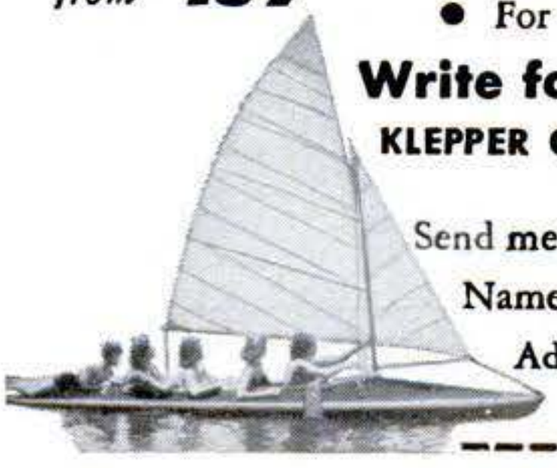

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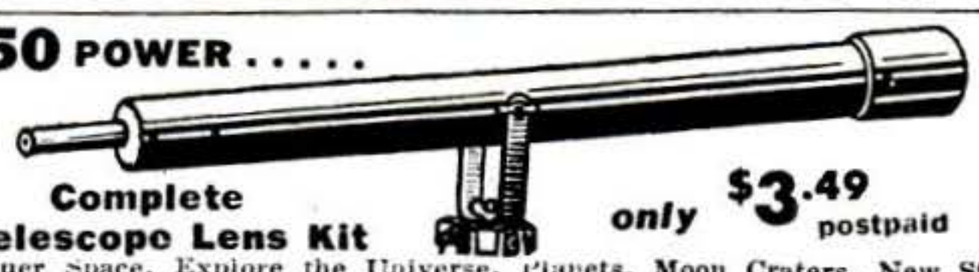

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650x16	5.55	670x15	5.15	700x17	8.75	750x20(8)	12.65
650x16(6)	7.05	710x15	5.25	750x17	10.55	825x20	17.55
700x16	6.15	760x15	5.75	750x15	10.45	900x20	17.65
750x16(6)	8.35	800x15	6.05	825x15	10.45	1000x20	16.55
550x18	3.95	820x15	6.15	600x20	8.75	1100x20	17.05
550x17	4.25	670x16	5.05	650x20	9.55	1100x22	17.95
650x15	5.05	760x15	7.05	32x6(8)	10.52	1000x22	17.95
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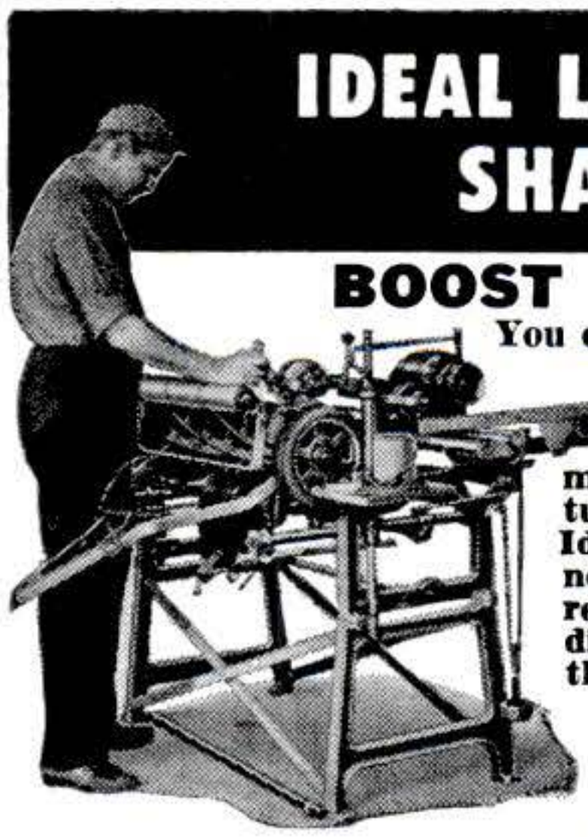

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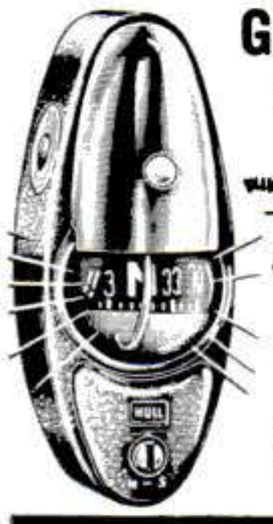

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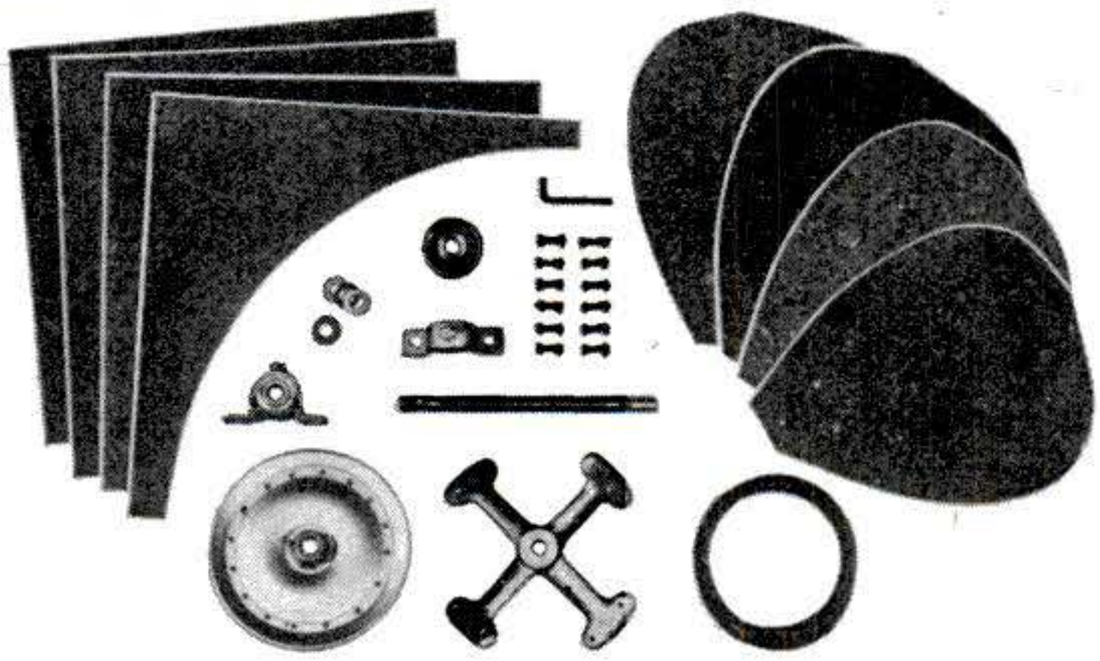

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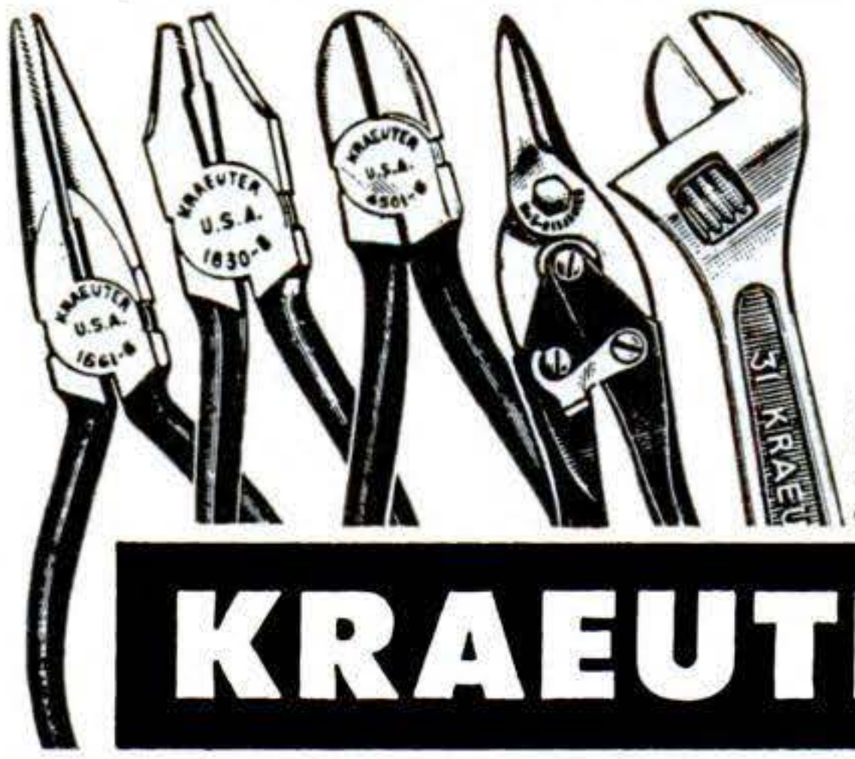

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28"x38"x20"

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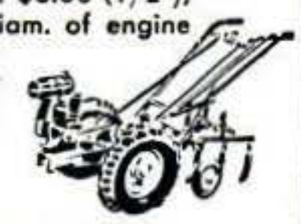

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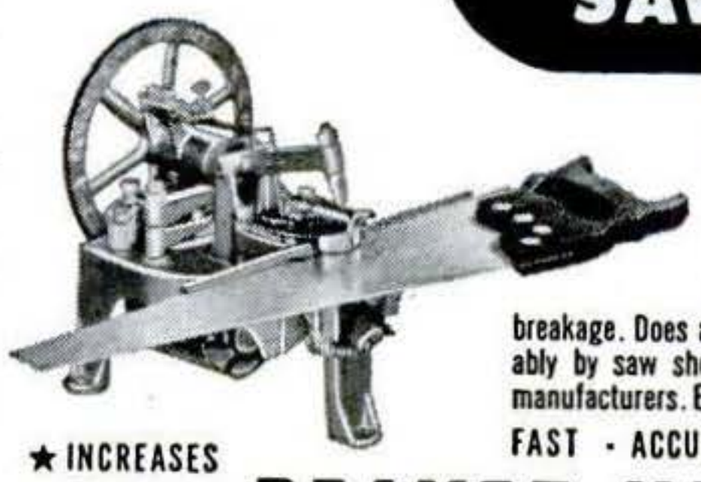

Sets 400 teeth per minute on hand or band saws 4½ to 16 point. Hammer and anvil action sets teeth accurately and uniformly . . . No tooth breakage. Does a perfect job. Used profitably by saw shops everywhere and saw manufacturers. Every machine guaranteed!

★ INCREASES PROFITS

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SAFETY FOR PASSENGERS AND CARGO THAT ONLY STEEL CAN GIVE

Full cabs cover entire body. Half cabs cover front passenger compartment.

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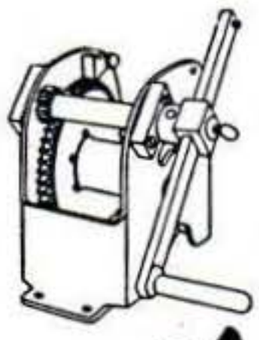

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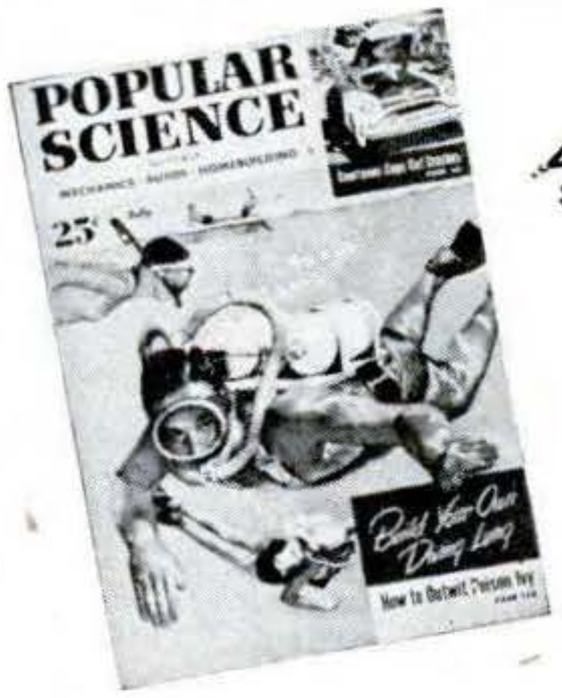

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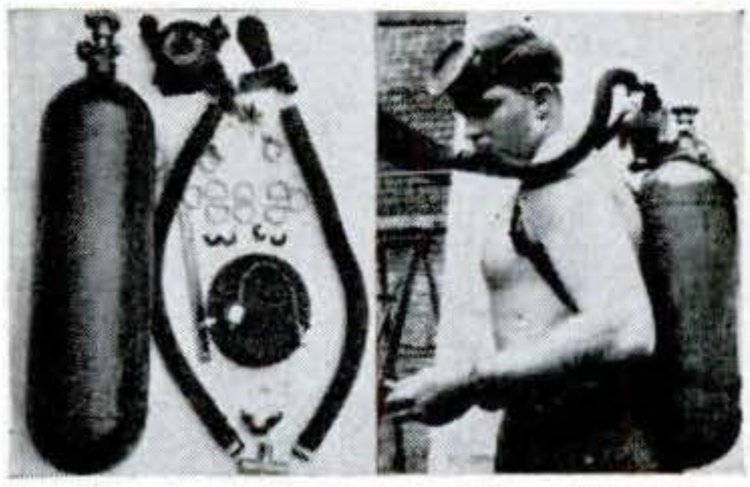

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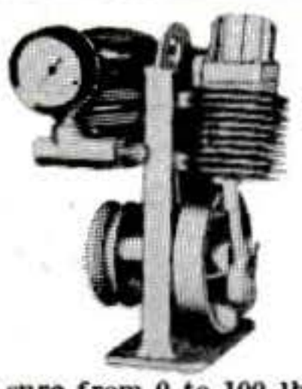

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I have personally pinpoint inspected every tire, as if our very future depended on it. Not 1 tire, I wouldn't use myself.

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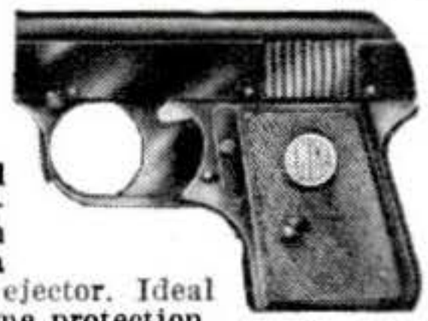

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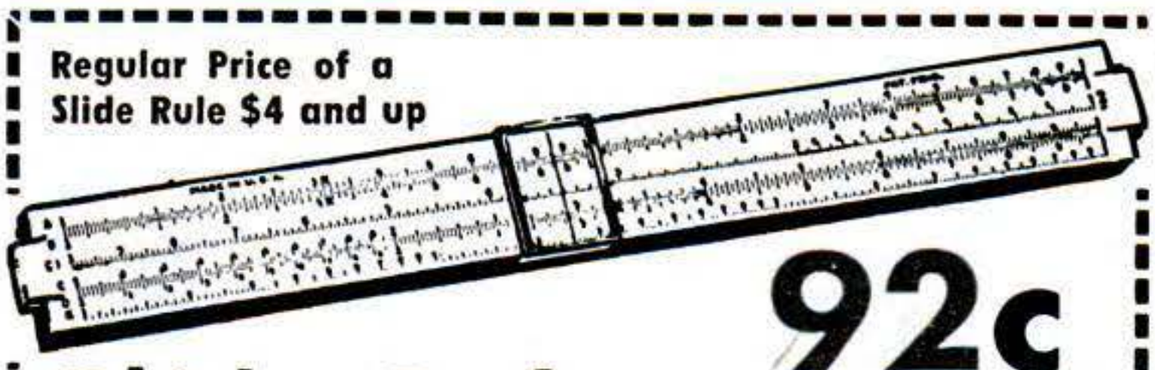

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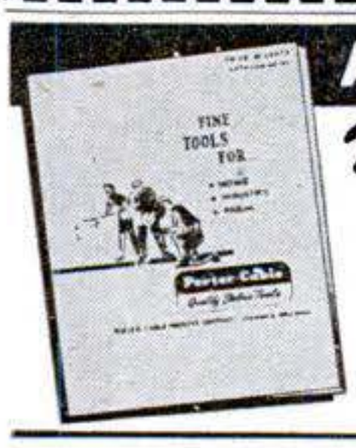

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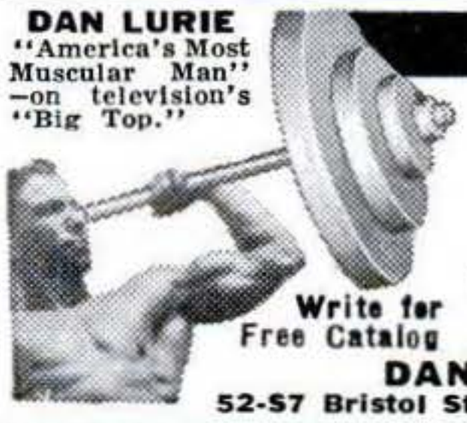

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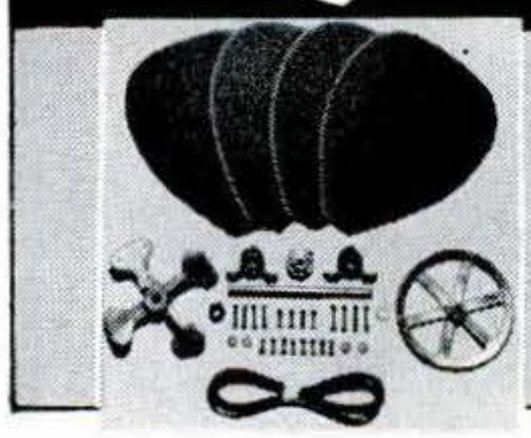

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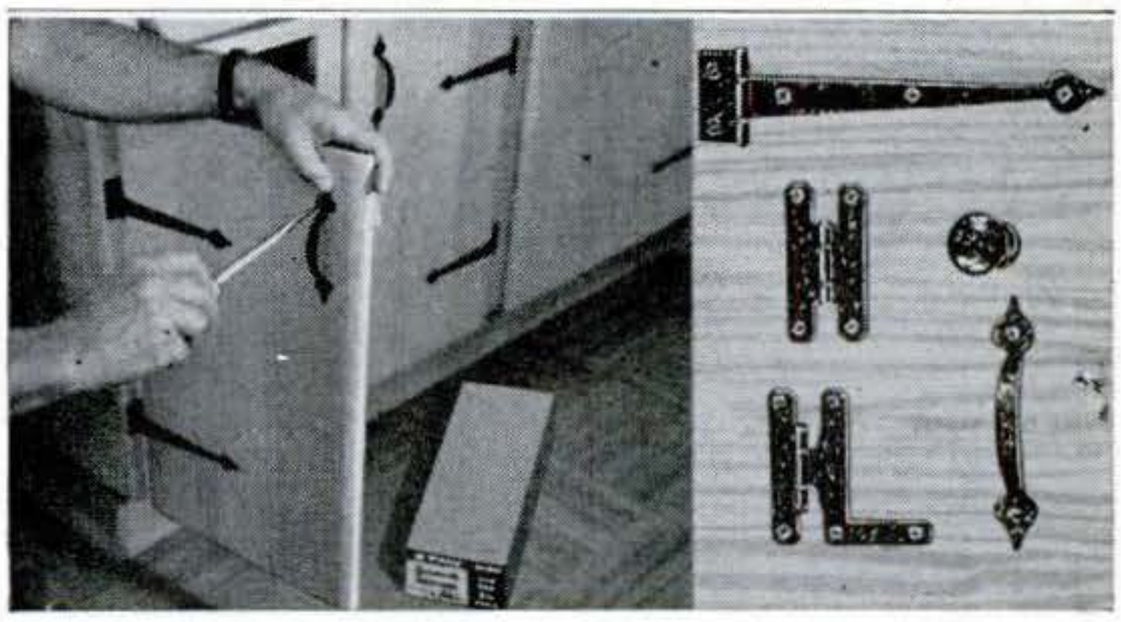

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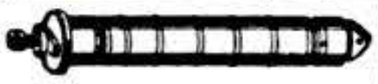

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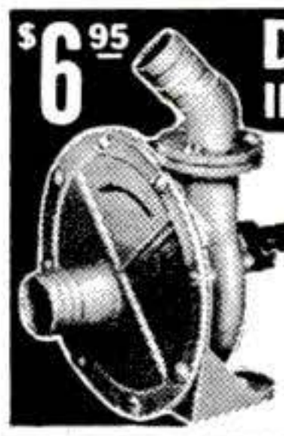

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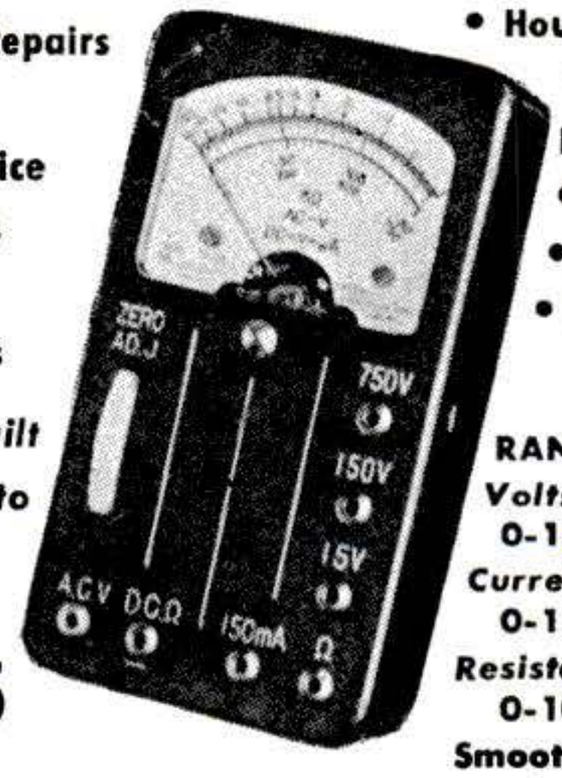

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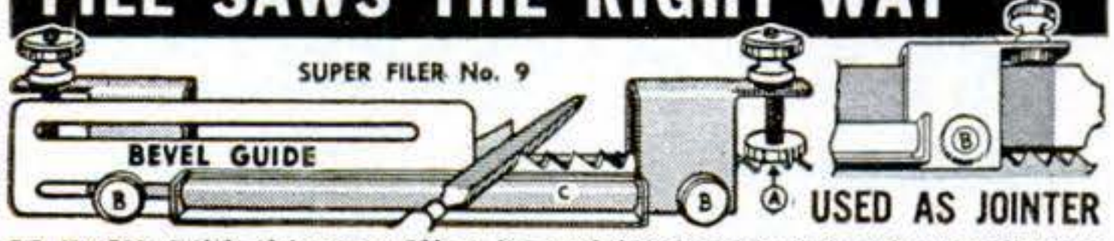

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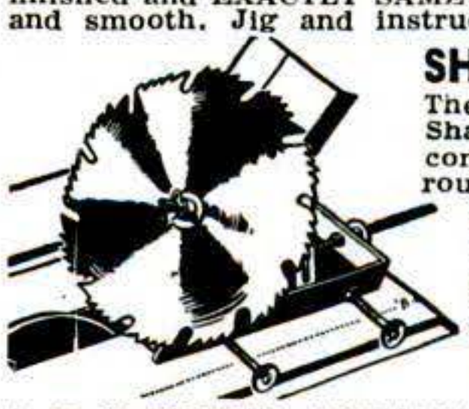

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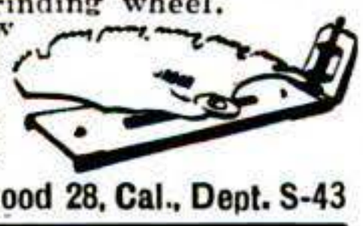

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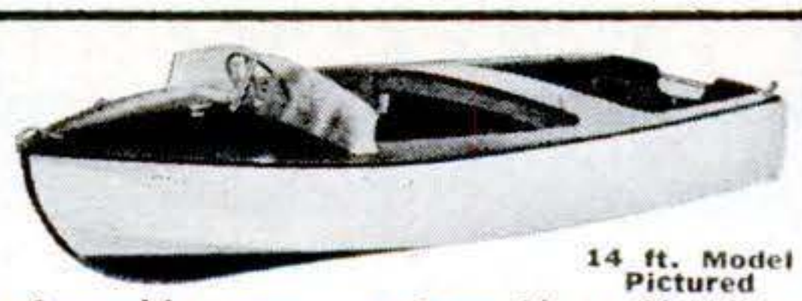

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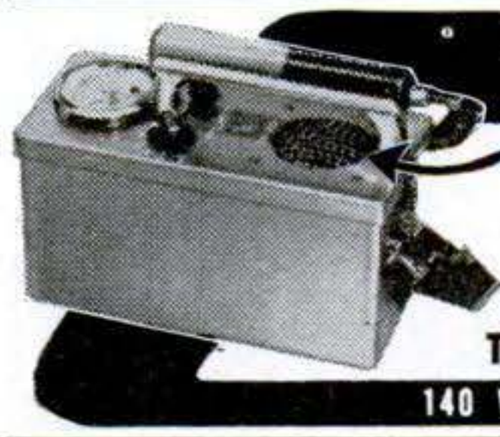

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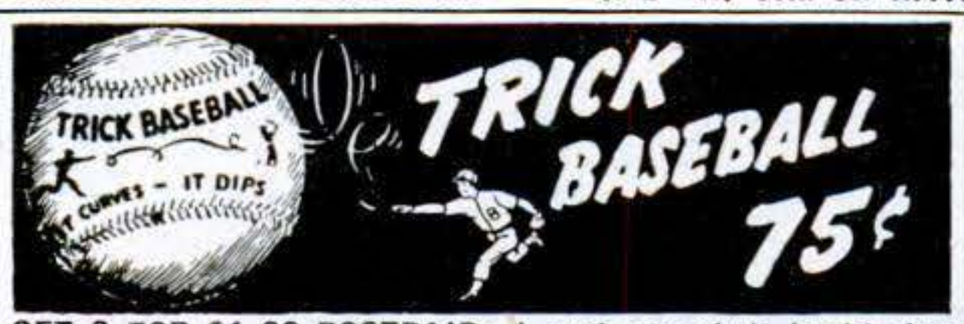

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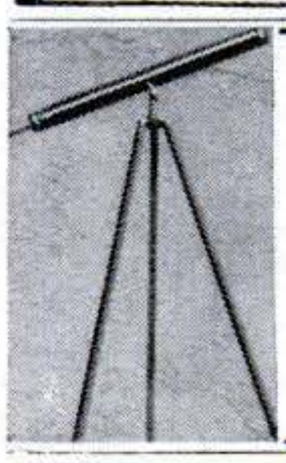

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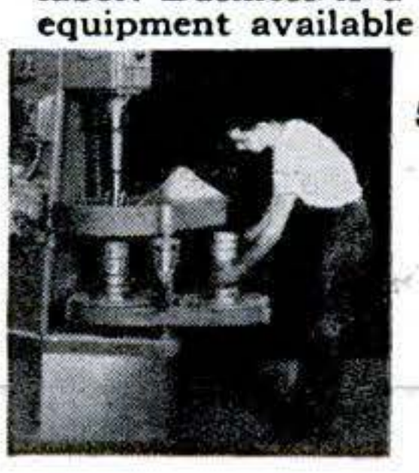

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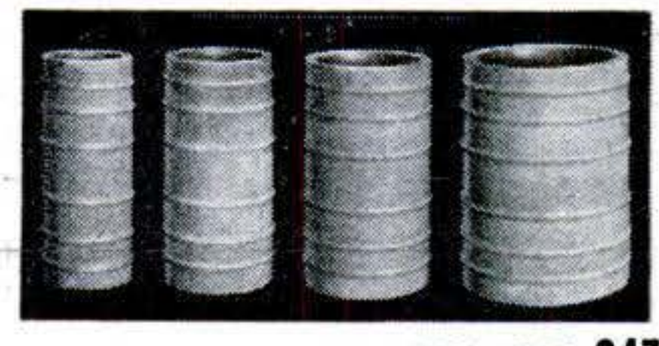

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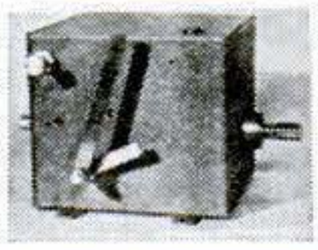

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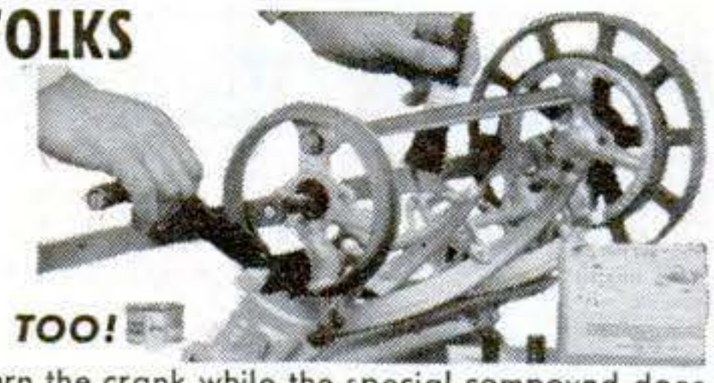

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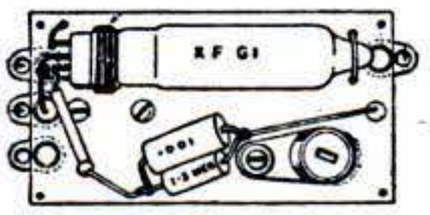

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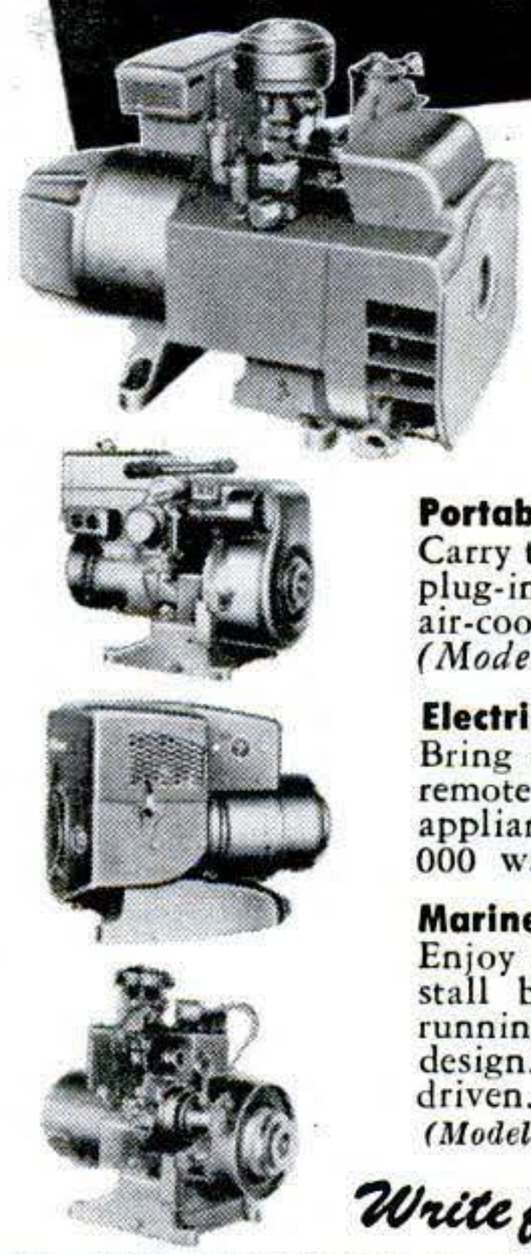

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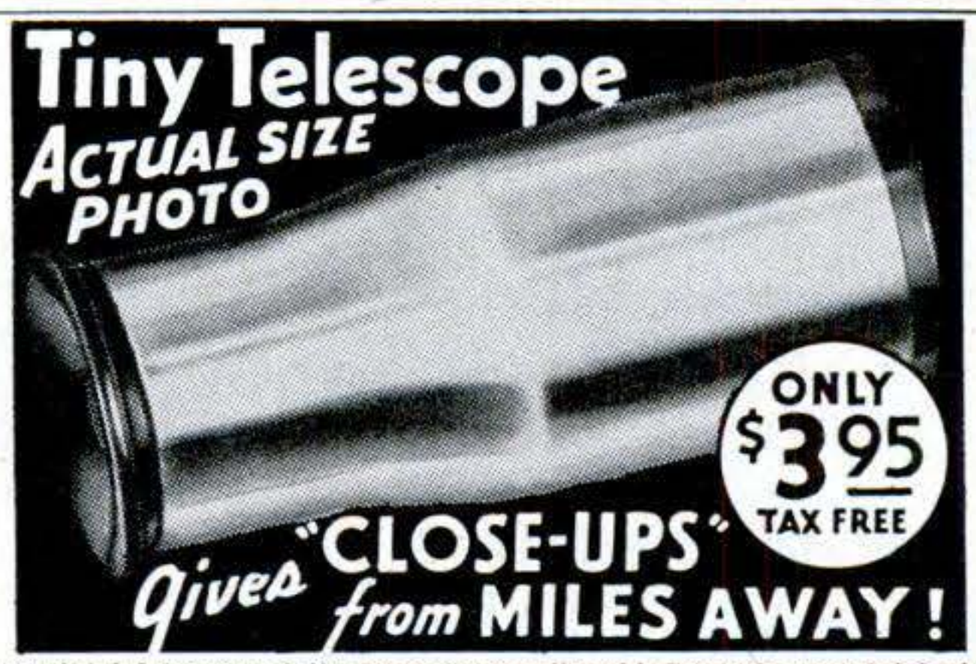

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Just fill glass vial with any color paint. Use like a fountain pen to stripe furniture, bikes, autos, model planes, toys, linoleum, wall board. Beautiful, clean, crisp results every time, like professional painters. No experience needed to draw straight, curved, circular or evenly spaced parallel lines. Can't clog or smear. May also be used with glue, tempera, textile paint, or ceramic underglazes. Paints on wood, glass, plastics, metal, fabrics and paper. Lasts a lifetime. Only **$1** postpaid, complete with tip for 1/16 inch stripe. C.O.D.'s plus postage. Used by industry. Order your Paint Striping Tool TODAY!

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Newest paint striping invention. Makes DOUBLE stripes—one wide and one narrow or two wide or two narrow **at the same time.** Or adapt quickly for wide or narrow single stripe. Makes 5 combinations. FREE—Send postcard for complete information...or order now... $2.95.

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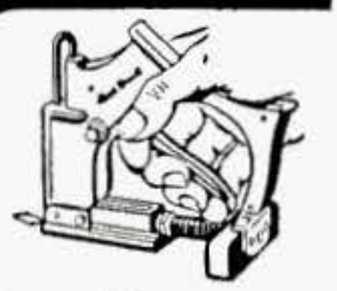

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20	4.00	5.50	3.25	4.50	1/2, 5/8, 3/4
24	4.50	6.50	4.00	5.50	1/2, 5/8, 3/4

Write for pamphlet on larger fan blades, wire guards, fan bases, shutters, pillow blocks, exhaust fan frames, etc. Dealers write for discount. Add 10% for packaging and shipping. Shipped C.O.D. or cash with order.

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Reading time: 3 minutes to learn how to

- **cut engine wear up to 38%**
- **prevent loss of power, compression**
- **save 15%-25% on oil . . . without ever changing your oil filter**

This Gadget is Worth $320,000,000

...and I Discovered it by Accident!

by Albert Wells

IT ALL STARTED the day I got the bill: $214.36 for an engine overhaul—and I had only 28,000 miles on the car!

I told my troubles to a neighbor—a lubrication engineer—told him how I'd always changed oil every 1500 miles, changed filters every 5,000 miles. His answer floored me.

"You've been wasting your money," he said. "We've spent millions developing oil additives that keep carbon, gum and abrasives from damaging your engine. Your oil costs about 15¢ more a quart because of those additives. Yet oil filters on the market today are made of rag or paper—they soak up additives like a blotter. The more often you change oil filters the more money you waste!"

"But don't I need a filter to take the impurities out of the oil?" I asked.

He took a deep breath. "This will really shock you. Engine damage is done by abrasives 10 to 40 microns in size (a micron is .000039"). Your oil filter can't take them out because rags or paper can't be packed tight enough without stopping oil flow when the fibers soak up oil and expand."

"Isn't there any kind of filter that does the job it's supposed to do?"

"No, except for the porous bronze filters they're making for supersonic aircraft. And you can't buy a filter like that for your car."

I asked myself: "Why not?" Next day, I tracked down the outfit that was making the filters for aircraft, and got the answer. These porous bronze filters were made by fusing together millions of tiny bronze balls. Non-absorbent, they didn't remove additives, yet they removed abrasives in the 10-to-40 micron danger zone. Could they be made for automobiles? Again, the answer floored me.

LIFETIME FILTER TESTED IN CARS, TRUCKS, BOATS

Test models had already been used in cars and trucks for millions of miles, proving the porous bronze filter: 1. Never needs replacing. 2. Saves the quart of oil thrown away with ordinary filter packs. 3. Increases engine life.

Trouble was, almost the entire production was being absorbed by military and industrial users.

That day I went to work on the biggest job of my life: setting up production of the Lifetime porous bronze permanent filters for cars and trucks (an estimated $320,000,000 replacement industry).

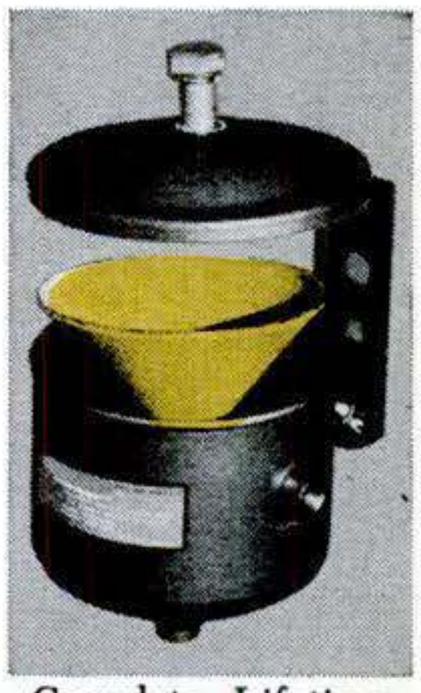
HOW TO GET A LIFETIME FILTER FOR YOUR CAR

Try the Lifetime filter on your car for 2 weeks: if it isn't all I say, you get your money back; if you keep it, you're through buying filter packs—the Lifetime filter is guaranteed for 10 years.

For complete unit, including case (install on any car in 10 minutes), send make, year and model of your car and $12.95 (we pay shipping).

For conversion kit, which replaces your present filter pack with Lifetime bronze, send make and number of filter and $6.95 (we pay shipping). NOTE: a few cars have full flow systems; conversions kits for these are $13.95.

Or send only $2 deposit, pay C.O.D. charges on arrival. But do it today—don't waste another cent on filter pack replacements!



Complete Lifetime Filter; fits any car.

Lifetime Conversion Kit; replaces ordinary packs with permanent bronze element.

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Permanent Filter Division, Dept. FPS-7
CONTINENTAL MANUFACTURING CORP.
Washington Blvd. at Motor Ave., Culver City, Calif.

Ship ☐ complete unit for_____
make, model, year of car

☐ conversion kit for_____
make and number of present filter

I enclose ☐ $12.95 for complete unit ($18.95—chrome)
☐ $6.95 for conversion kit (full-flow, $13.95)
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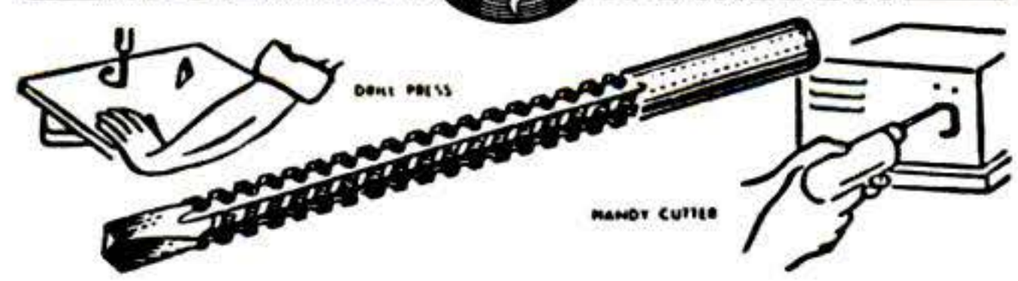

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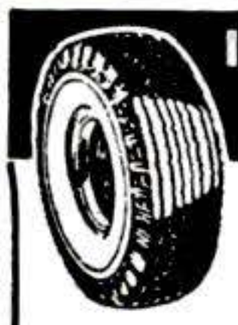

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650x16	5.75	670x15	5.35	700x17	11.95	750x20 *10*	17.50
650x16 *6*	7.25	710x15	5.45	750x17	16.45	825x20	21.50
700x16	6.35	760x15	5.95	750x15	10.95	900x20	19.95
750x16 *6*	8.45	800x15	6.35	30x5	11.25	1000x20	20.45
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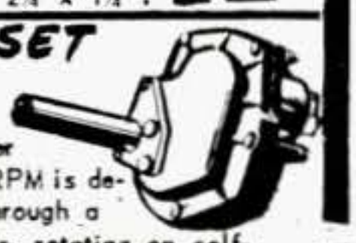

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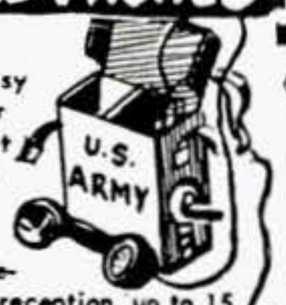

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NEW CO² NEPTUNE HARPOON GUN

SOLD EVERYWHERE AT $29.95 13.95

Has JET POWER – Simplest, most efficient underwater gun we know of. Designed for one arm use. Weighs only 27 ounces. Has 13 ft. of 150 lb. test NYLON line on a snag-proof line reel. Positive safety-catch. Rust resistant finish. All-metal body.
CO² CHARGES – Box of 10 charges for above gun. . . . ONLY 98¢

PAL SWIM FINS

New, first grade. Of top quality flexible rubber with treaded bottom and adjustable heel strap. Will float and are fully waxed for speed and protection. Vented for air and drainage. Sizes: Small, Med., large. 7.95 VALUE 2.99

DIVING MASK
WITH 2 BUILT-IN
SNORKLE TUBES

As seen in June Popular Science. Has full face mask covering mouth and nose. Two built-in snorkle breathing tubes. 10.95

DIVING MASKS

Made of gum rubber with a sturdy glass lens and adjustable head strap. A Bargain!
SMALL 99¢ MED. 1.49 LARGE 1.89

NEW SURPLUS WADING SUIT

Back in stock AGAIN! Will make surf and deep stream fishing a real pleasure. Ideal for use wherever it is necessary to protect the body or clothes from muck, moisture, silt, etc. Made to finest Gov't specifications. Originally used as an Overboard suit in landing operations. Made of heavy duty rubberized canvas. Has vulcanized seams and built-in rubber gloves & boots. 10.95

100-200-300 POWER MICROSCOPE

A PALLEY BARGAIN! Has fully ground and polished achromatic lenses. A triple revolving lens turret with 100–200–300 Power objectives. Adjustable plano- sub-stage mirror. All-metal body is built to incline through 90°. Comes in handsome dovetailed hardwood case Ideal for students, home labs, amateur scientist, schools, etc. This remarkable value for ONLY 9.49

ARMY RIFLESCOPE

Built to rigid gov't specifications. Contains the finest precision, achromatic optics. Has five double-element lenses – fully corrected for color and spherical abberation. 3 power magnification. Dot reticle. Length 9" 9.95
NOTE: We are now designing a special mount for this scope. WRITE for Details.

SAVE $8.00 ON THIS .22 CAL. AIR RIFLE

Take advantage of our Bankrupt Stock BUY! SAVE! Made in Belgium for Hy-Score. Requires no pumping, just cock & fire. Has ALL STEEL, fully rifled barrel, 17½" long A beautiful natural finish, hardwood stock, Takes .22 caliber pellets or darts. An ideal training rifle for youngsters and excellent for indoor target practice. Overall lgth., 40½". Weight 5 pounds. Quantity limited. 10.95

ARMY COMPASS

Officers lensatic type. Has peep sight and hairline guide in cover for sighting on a distant object. 360° rotating bezel ring for computing. $5.95 value! 3.95

AIR CORPS RUBBER BOATS USAF SURPLUS

Made to government specifications. An ideal boat for Fishing or Hunting in river, lake or ocean. Safe, lightweight, easy to pack. Reconditioned and ready to use.
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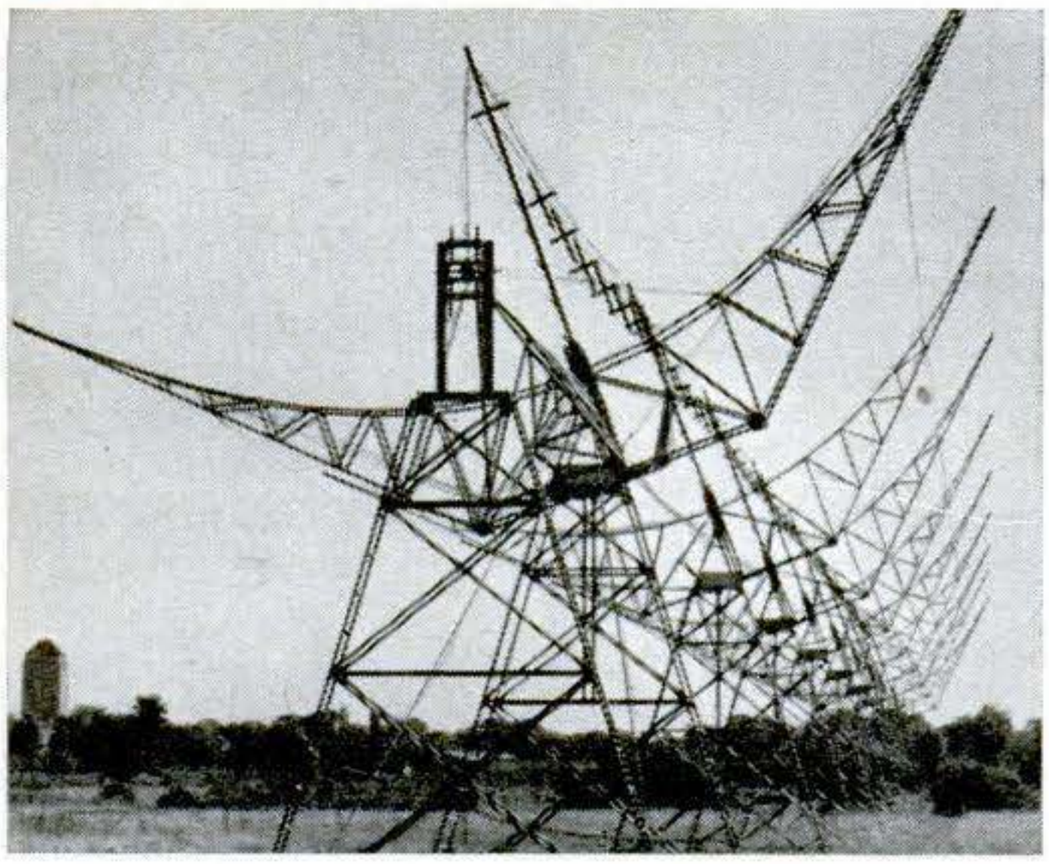
How Much Did You Learn?

By Stanford E. Taylor and Helen Frackenpohl
Washington Square Reading Center, New York

Now you can sample how much you remember of the useful and interesting information packed into this issue of POPULAR SCIENCE MONTHLY. Answers to the questions are printed just below the quiz. After each answer is a page reference to the article on which the question was based.

1. *With only 110 hp., Plymouth rates highest in its field in*
a. breakaway torque
b. power-to-weight ratio
c. top speed

2. *This structure is a*



a. UHF television transmitter
b. radio telescope
c. dirigible dock

3. *The intense pain from a sting-ray wound is caused by*
a. the unusual depth of the wound
b. bacterial infection
c. venom from the sting ray

4. *Washing your car with household soap is inadvisable because*
a. it's too strong, may remove paint
b. it takes too much work
c. it's hard to wash off, leaves a scum

5. *In taking pictures under water, you should stay within six to 15 feet of*
a. the surface
b. your subject
c. a safety line

6. *The new adhesive cements make laying tile a breeze, except where*
a. there is too much moisture
b. imperfect work may be too visible
c. the surface is not sound and level

7. *Motels now outnumber hotels throughout the country by*
a. two to one
b. three to one
c. four to one

8. *The mysterious pockmarks on windshields this spring were found to be caused primarily by*
a. vandalism
b. ordinary road damage
c. temperature changes

9. *One square yard of a new sun-powered battery would yield*
a. 70 watts of power
b. 50 watts of power
c. 10 watts of power

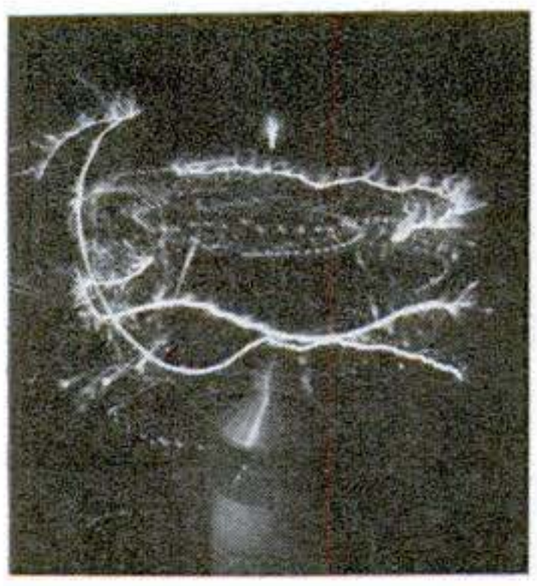
10. *Proponents of the air-cooled Franklin car claim greater motor efficiency because it runs at*
a. 180-212 degrees
b. 280-320 degrees
c. 350-450 degrees

Answers: 1. a—p. 104; 2. b—p. 78; 3. c—p. 117; 4. c—p. 132; 5. b—p. 150; 6. c—p. 182; 7. a—p. 112; 8. b—p. 55; 9. b—p. 71; 10. c—p. 92.

NEXT MONTH . . .

Spectacular Stunts with a Homemade Tesla Coil

If you are one of the hundreds of readers who have expressed interest in building a modern Tesla coil, don't miss the August issue of PSM. Step-by-step photos will picture the construction of a rig that will perform colorful and exciting feats of electrical magic.



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110-120 v. 60 cyc. AC. absolutely the best made — exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid mounted — portable. Powered by an easy starting Briggs or 6 HP Wisconsin engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty. (Item 31) Wt. 210 lb. Reg. price $585. Special at..... **$299.50**
Same plant with electric self starter (Item 31a)..... **$359.50**
Generator only and control box....**$169.50**
DUAL VOLTAGE 110-220 available on any of above models for $28.00 additional.

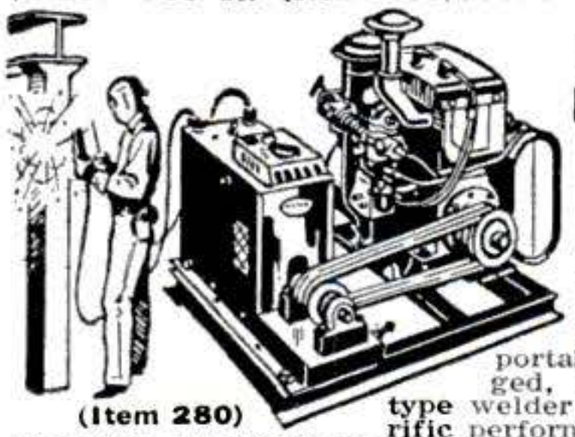
JET STEAM MASTER

Now, a new super efficient portable steam generator that provides live steam at 100 lbs. pressure in 60 seconds from a cold start! The first quality steam blaster ever offered at this low price. Instantly cleans sticky grease, dirt, rust, old paint, etc., off motors—farm implements and road machinery. Pays for itself in a few weeks. Sterilizes as it cleans — milking machines, tanks, milk lines, hog houses, chicken houses and breeding pens. Ideal for: sterilizing soil in greenhouses and hot beds—thawing out frozen earth, water pipes, materials, etc. Melts ice, snow in a flash. Fully automatic—oil fired with built-in water circulating pump. Draws water from faucet or from barrel or bucket. Simple and safe, anyone can use it—built-in safety valve. Complete with new triple efficiency jet steam gun—automatically mixes in soap or detergent if desired. Has 10" semi-pneumatic wheels. Wt. 250 lbs. (Item 463) Spec. factory price... **$298.00**

EXTENSION CORD

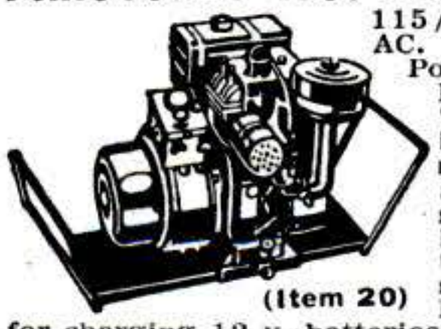
(Item 16a) Heavy duty, made of Buna rubber insulated #14-2 conductor, stranded wire encased in a treated braid jacket. **So tough that you can drive over it.** Use indoors or out. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Complete with heavy rubber plug and outlet. (Item 16) 40 ft. 2½ lbs..... **$1.99**
Combination 2-40 ft. and 1-20 ft. (total 100 ft.).....(Item 16c) **$4.95**
NEOPRENE CABLE #14-2 (Item 185) Heavy duty, very flexible, 20 year quality. Wt. 9 lbs. 100 ft. Complete with rubber plug and outlet. *A terrific buy at only*..... **$8.95**
NO. 12-2 POWER CABLE. Very flexible rubber covered, special outside shield for grounding power tools, etc. 50 ft. (Item 199) wt. 8 lbs. **$6.95.** 100 ft. (Item 200).....**$12.95**

POWER MASTER DC ARC WELDERS


(Item 280)

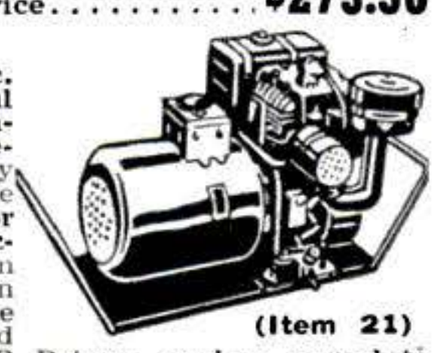
Now! a portable, rugged, industrial type welder with terrific performance, yet at a price hundreds of dollars less than you'd expect. Senior model made for years of trouble-free, continuous service. High capacity DC welding unit enables you to tackle any job with confidence—easily welds anything up to 2" plate using from 1/16" to ¼" rods. Built-in stabilizer and cooling system makes arc easy to strike and hold. Dual control rheostat provides low heat soldering, brazing and welding from 30 to 300 amps. Complete with instructions, guarantee and triple V-belt or flat pulley. You can pay more, but you can't buy a better welder.
COMPLETE POWER MASTER (Illustrated above) powered by a 14 hp., air cooled Wisconsin engine. Wt. 480 lbs. (Item 280) Compares with welder costing $1200. Factory price..... **$449.50**
WELDER ONLY — DUAL CONTROL MODEL. Same as above, but drive with your tractor, jeep or gas engine of 14 HP or more. (Item 38a.) Wt. 110 lbs. $450 value..... **$119.50**
WELDER ONLY—STANDARD MODEL. Same as above but with single rheostat for heavy metal welding only. (Item 38.) Wt. 110 lbs. $400 value. Special... **$99.75**
WELDING KIT Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at..**$10.50**

PORTO-POWER 1500-1700 WATT PLANT


(Item 20)

115/120 v. 60 cyc. AC. Push button start. Powered by a 4 HP Briggs engine. This plant combines the compactness and easy portability of the smaller plants, but has a high output to handle heavier starting loads. Built-in winding for charging 12 v. batteries. An ideal standby power plant for operating lights, sump pumps, oil burners and communication systems. Perfect for contractors and line crews. (Item 20.) Wt. 146 lbs. Factory Special Price..... **$279.50**

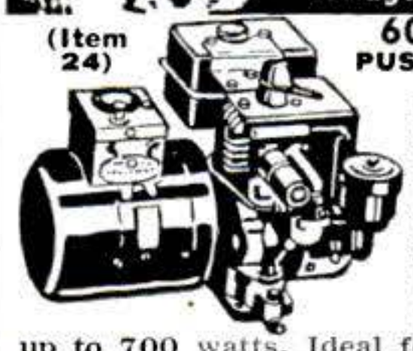
MASTER-LITE 2500 Watt Plant


(Item 21)

110/120 v. 60 cyc. AC. A powerful plant, ruggedly constructed and yet designed for easy portability. Can be started by rope or built-in 12 v. electric push button starter. Built-in winding to charge battery. Powered by a big 5.10 HP Briggs engine, complete with all accessories. Includes control box, voltmeter, and handy plug-in power receptacle. An ideal plant for permanent or stand-by service. Wt. 225 lb. Reg. price $645.00 (Item 21) Factory Price..... **$329.50**
3000-3500 WATT PLANT (Item 198) 110-220 v. 60 cyc. AC Belt Drive. Wis. engine Push Button Start. Wt. 370 lbs. Heavy duty..... **$399.50**
GENERATOR ONLY for belt drive..**$239.50**

PORTABLE LIGHT PLANTS

Ideal for your camp, cottage, trailer or boat!


(Item 24)

600-700 WATTS PUSH BUTTON START

115 v. 60 cyc. AC Powered by a rugged 2 HP easy starting Briggs engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for Civil Defense and Fire Dept. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. (Item 24.) Wt. 75 lbs. Easily fits in car trunk. Be prepared if storm knocks out power lines. Reg. $275 value.... **$143.50**
1000-1200 Watt Plant (Item 45) same as Item 24 but larger generator and engine with 50% greater output..... **$199.50**
LITTLE GIANT—350 WATT (Item 273) 115 v. DC 1½ hp. Briggs engine. Perfect for lights, radios, small power tools. Wt. 65 lbs. Factory price..... **$99.75**
We make fully automatic controls to operate any of the above light plants. Write for details. **We make all sizes up to 25,000 Watts.**

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range removes kitchen smoke and odors. Powerful, continuous duty motor, 110-120v. AC. Mount in wall or ceiling to ventilate any area. Quiet, super-efficient fan moves huge volume of air. (400 to 600 CFM).
8" Fan, wt. 5 lb.....**$6.85**
9" Fan, wt. 6 lb.....**$7.85**
10" Fan, wt. 7 lb.....**$8.85**
12" Fan, wt. 8 lb.....**$9.85**
HEAVY DUTY FAN. Semi-enclosed motor, suitable for spray booths, restaurant exhausts, poultry houses, etc. 10" Fan, wt. 8 lbs. (Item 10E).....**$11.95**
12" Fan. wt. 10 lbs. (Item 10D)....**$12.95**

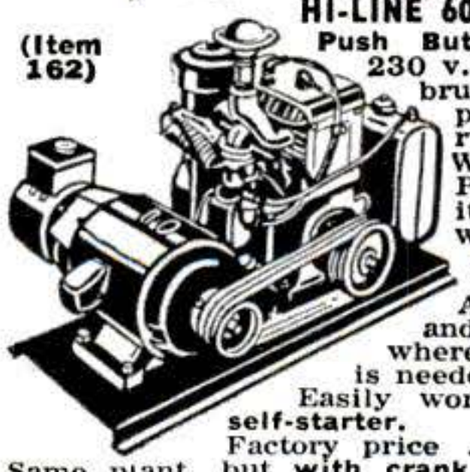
CONDITIONAIRE VENTILATING FANS

Save big money installing your own exhaust fan. Efficient propellor type blade moves huge volume of air quietly and effortlessly. Heavy welded frame — predrilled for easy installation. Just cut opening and bolt in place. **Continuous duty** motors. Ideal for attics, restaurants, garages, barns, chicken houses, etc. Control manually or with thermostat.

Blade	Opening	CFM	Wt.	Item	
16"	18¼"	2925	19 lb.	365a	$27.95
18"	19¼"	3600	27 lb.	365b	$31.95
20"	21¼"	4100	30 lb.	365c	$39.95

SHUTTERS—open automatically, 16", wt.10 lb. **$9.00**; 18", Wt. 12 lb., **$10.25**; 20" Wt. 14 lb. **$11.25.**
THERMOSTATS: BARN type (range 40°-60°). Wt. 2 lbs. **$6.95.** ATTIC type (50°-90°). Wt. 2 lbs.....**$11.95**

HI-LINE 6000 WATT PLANT

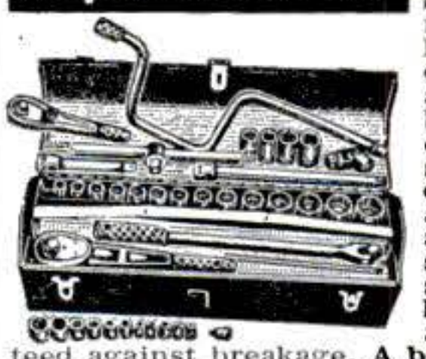

(Item 162)

Push Button Start 115-230 v. 60 cyc. A.C. A brute of a power plant with a rugged 14 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth $995. **With self-starter.** Factory price **$645.00**
Same plant, but **with crank start, $585.50**
Generator and control box only, belt driven. Use your own engine or tractor. Wt. 240 lbs. (Item 163) Factory price **$345.00**

9 TON HYDRAULIC PRESS

A tremendously powerful hydraulic press, capable of exerting 18,000 lbs. pressure. Pays for itself many times over—straightening bent connecting rods, king pins, crankshafts, axles, link pins and bars — or pushing out frozen bearings and bushings. Developed pressure under precise control and visible at all times on accurate gauge. Complete with both large and small anvils and jigs to straighten any kind of curve or bend. (Item 464) Wt. 110 lb. Actual list price $365. Our special close-out price.... **$69.50**

52 pc. SOCKET SET



Highest quality, guaranteed non-breakable sockets made by Husky. Beautifully matched chrome thin wall alloy absolutely the best. Contains a complete set of 28 sockets in ½" drive, ⅜" drive and ¼" drive, plus all necessary extensions, handles, speeders, reversible ratchets, etc.; all uncond. guaranteed against breakage. A beautiful set of tools that will handle any job; in a big doghouse steel box. Wt. 17 lbs. (Item 205) List price $62.90. Factory special.. **$27.95**

44 Pc. SOCKET SET

(Item 596) Same unconditionally guaranteed, non-breakable sockets as above. Complete range of 21 sockets from ¼" thru 7/16" (¼" drive) & 7/16" thru 1-1/16" (½" drive). Two extensions, reversible ½" ratchet, 3 drift punches, sliding "T" head, all angle coupling, ½" speeder, ¼" breakover, 5 pc. high chrome alloy combination wrench set and 8 pc. offset wrench set in big doghouse tool box with ample room for other tools. Reg. $49.50. Wt. 16 lb..... **$21.95**

MASTER AIR COMPRESSOR

Tank Tested up to 500 lbs. per sq. in.

COMPARE! This is the only compressor built with a NO RUST stainless steel tank. Safe up to 500 lbs. (Item 209) High pressure type for large volume of air for heavy duty service. For paint spraying, inflating truck & auto tires, greasing & the hundreds of other jobs done by compressed air. Piston type. 2" bore compressor with built-in air filter. Master built with high strength alloys and precision bearings. Tank, 12"x24", 2100 cu. in. cap. Equipped with automatic switch that starts and stops motor to maintain desired pressure (up to 150 lbs.) and check valve, safety valve, gauge, shut-off valve, 20 ft. air hose and tire chuck. Beautifully balanced on ball bearing wheels and rubber tires. Don't take chances with used or surplus equipment. Our compressors are factory new and are guaranteed **SAFE.** Low factory prices. With ⅓ HP., 110 v. AC motor. Reg. $175. (Item 209p)..... **$109.50**

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Pressure Regulator, solid brass, std. ¼" pipe thread, reduces any pressure to a range of 0-50..... **$3.75**
Pop (safety) Valve, adjustable from 0-200 lbs. ¼" pipe thread..... **$1.40**
SPECIAL . . . All four above.....$8.95
Pressure Switch for pumps and compressors, 0-85 lbs., **$5.95**; 0-150 lbs. with unloader (3 HP), **$10.95**; 0-200 lbs. (5 HP), **$12.95**

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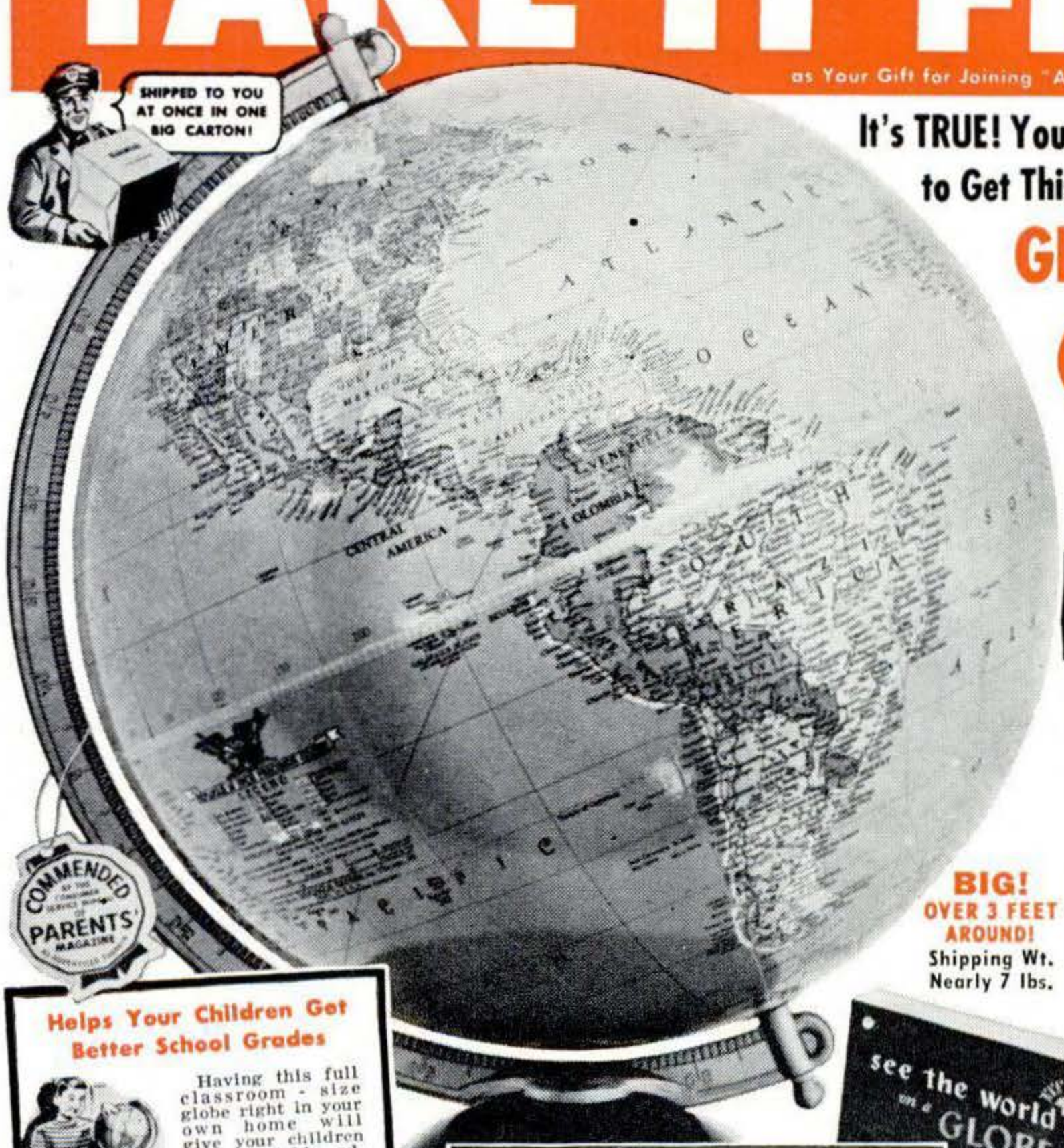

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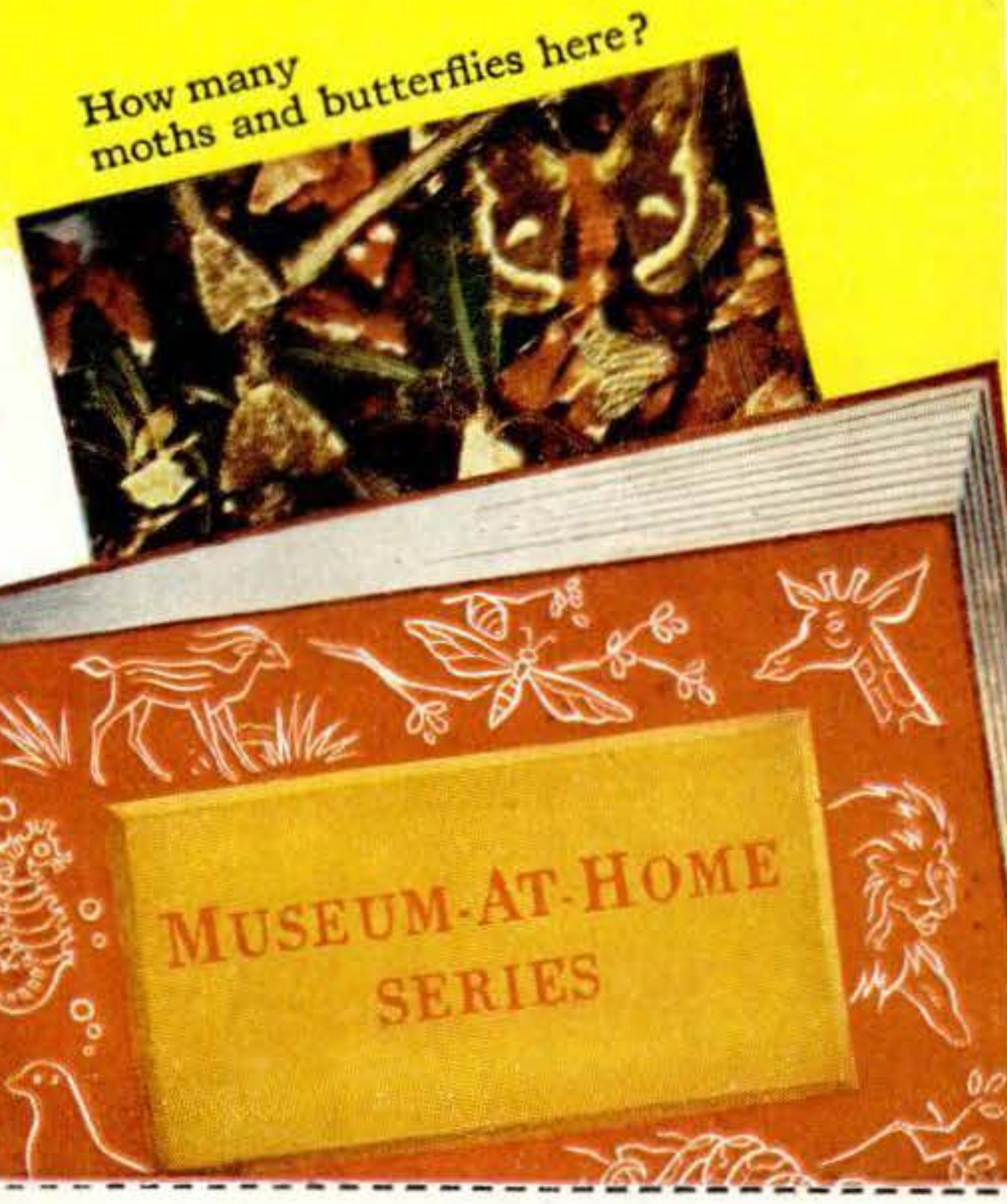

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